US011226164B2

(12) **United States Patent**
Higashiiue et al.

(10) **Patent No.: US 11,226,164 B2**
(45) **Date of Patent: Jan. 18, 2022**

(54) **STACKED HEADER, HEAT EXCHANGER, AND AIR-CONDITIONING APPARATUS**

(71) Applicant: **Mitsubishi Electric Corporation**, Tokyo (JP)

(72) Inventors: **Shinya Higashiiue**, Tokyo (JP); **Shigeyoshi Matsui**, Tokyo (JP); **Takehiro Hayashi**, Tokyo (JP)

(73) Assignee: **Mitsubishi Electric Corporation**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 167 days.

(21) Appl. No.: **16/086,374**

(22) PCT Filed: **May 23, 2016**

(86) PCT No.: **PCT/JP2016/065180**
§ 371 (c)(1),
(2) Date: **Sep. 19, 2018**

(87) PCT Pub. No.: **WO2017/203566**
PCT Pub. Date: **Nov. 30, 2017**

(65) **Prior Publication Data**

US 2019/0093965 A1 Mar. 28, 2019

(51) **Int. Cl.**
F28F 9/02 (2006.01)
F28D 1/053 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***F28F 9/0278*** (2013.01); ***F25B 39/028*** (2013.01); ***F28D 1/0435*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC F25B 13/00; F25B 39/028; F25B 39/04; F28D 1/0435; F28D 1/0476;
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,829,780 A * 5/1989 Hughes F28F 13/04 62/288
5,241,839 A 9/1993 Hughes
(Continued)

FOREIGN PATENT DOCUMENTS

CN 202902982 U 4/2013
CN 105378421 A 3/2016
(Continued)

OTHER PUBLICATIONS

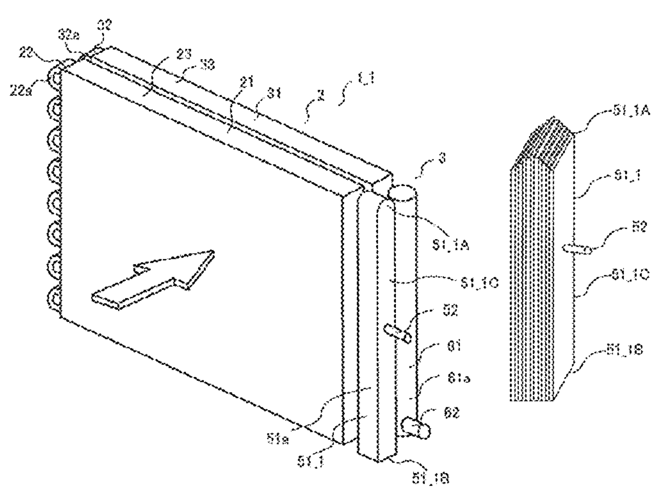
Laura Firszt, 10 Popular Roofing Styles: Which is the Best for You?, Sep. 17, 2014, networx.com, https://www.networx.com/article/10-popular-roofing-styles-which-is-the (Year: 2014).*
(Continued)

Primary Examiner — Larry L Furdge
Assistant Examiner — Chang H Park
(74) *Attorney, Agent, or Firm* — Posz Law Group, PLC

(57) **ABSTRACT**

A stacked header branches one flow path into a plurality of flow paths. The stacked header includes an upper end part positioned at an upper end of the stacked header in a gravity direction, a lower end part positioned at a lower end of the stacked header in the gravity direction, and a flow path forming part positioned between the upper end part and the lower end part and having a flow path formed in the flow path forming part. At least one of the upper end part or the lower end part is a non-horizontal face part having a non-horizontal face slanted with respect to a horizontal plane.

11 Claims, 13 Drawing Sheets



(51) **Int. Cl.**

F28D 1/047	(2006.01)
F25B 39/02	(2006.01)
F28F 9/26	(2006.01)
F28D 1/04	(2006.01)
F28D 21/00	(2006.01)
F28F 1/32	(2006.01)
F25B 39/04	(2006.01)
F25B 13/00	(2006.01)

(52) **U.S. Cl.**
CPC ***F28D 1/0476*** (2013.01); ***F28D 1/05391*** (2013.01); ***F28F 9/0221*** (2013.01); ***F28F 9/262*** (2013.01); *F25B 13/00* (2013.01); *F25B 39/04* (2013.01); *F28D 2021/0068* (2013.01); *F28F 1/32* (2013.01)

(58) **Field of Classification Search**
CPC F28D 1/05391; F28D 2021/0068; F28F 1/32; F28F 9/0221; F28F 9/0278; F28F 9/262
USPC 165/173
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,036,567 B2 * 5/2006 Shimanuki F24F 13/222 165/110
10,054,376 B2 * 8/2018 Higashiiue F28F 9/026
2014/0290296 A1 * 10/2014 Katoh B60H 1/3227 62/238.7
2016/0195335 A1 7/2016 Nishiyama et al.
2016/0245596 A1 8/2016 Higashiiue et al.

FOREIGN PATENT DOCUMENTS

FR 2037366 A5 12/1970
JP S58-071651 U 5/1983
JP H03-036497 A 2/1991
JP H03-046759 U 4/1994
JP H06-137779 A 5/1994
JP 2001-066088 A 3/2001
WO 2015/063857 A1 5/2015

OTHER PUBLICATIONS

Office Action dated Mar. 9, 2020 issued in corresponding CN patent application No. 201680085744.5 (and English translation).
Office Action dated Mar. 18, 2020 issued in corresponding European patent application No. 16903048.3.
International Search Report of the International Searching Authority dated Aug. 9, 2016 for the corresponding international application No. PCT/JP2016/065180 (and English translation).
Extended European Search Report dated May 3, 2019 issued in corresponding EP patent application No. 16903048.3.
Examination Report dated May 14, 2019 issued in corresponding AU patent application No. 2016408458.
Office Action dated Nov. 24, 2020 issued in corresponding CN patent application No. 201680085744.5 (and English machine translation).

* cited by examiner

FIG. 1

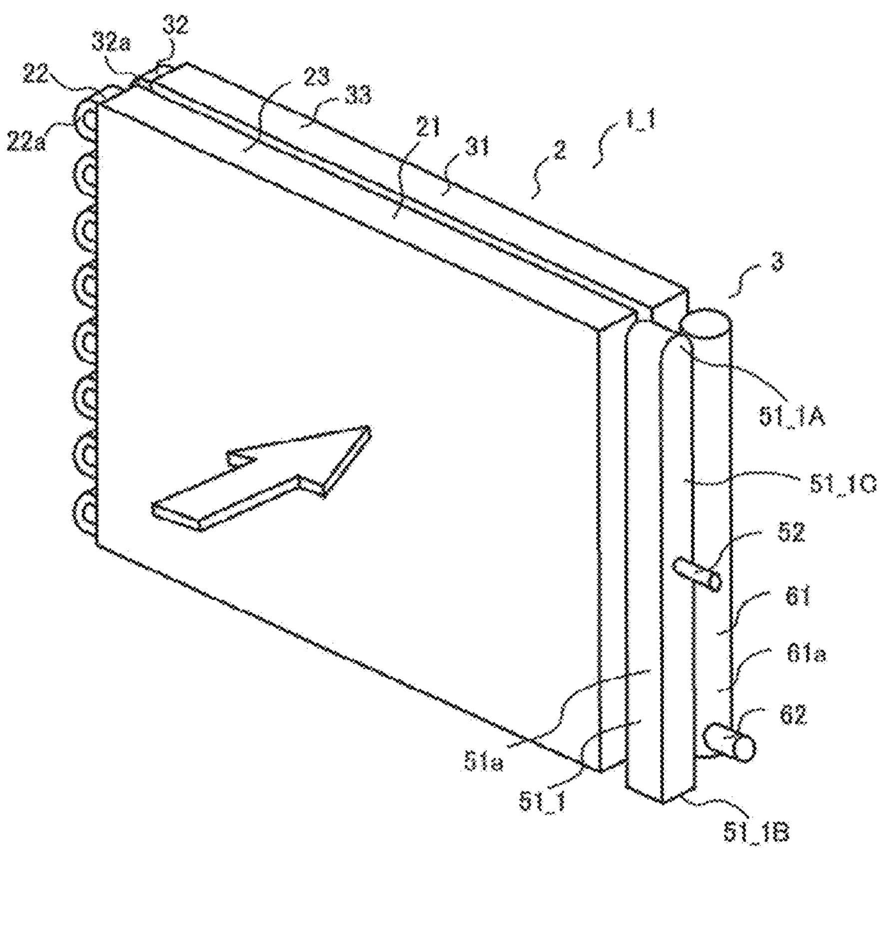


FIG. 2

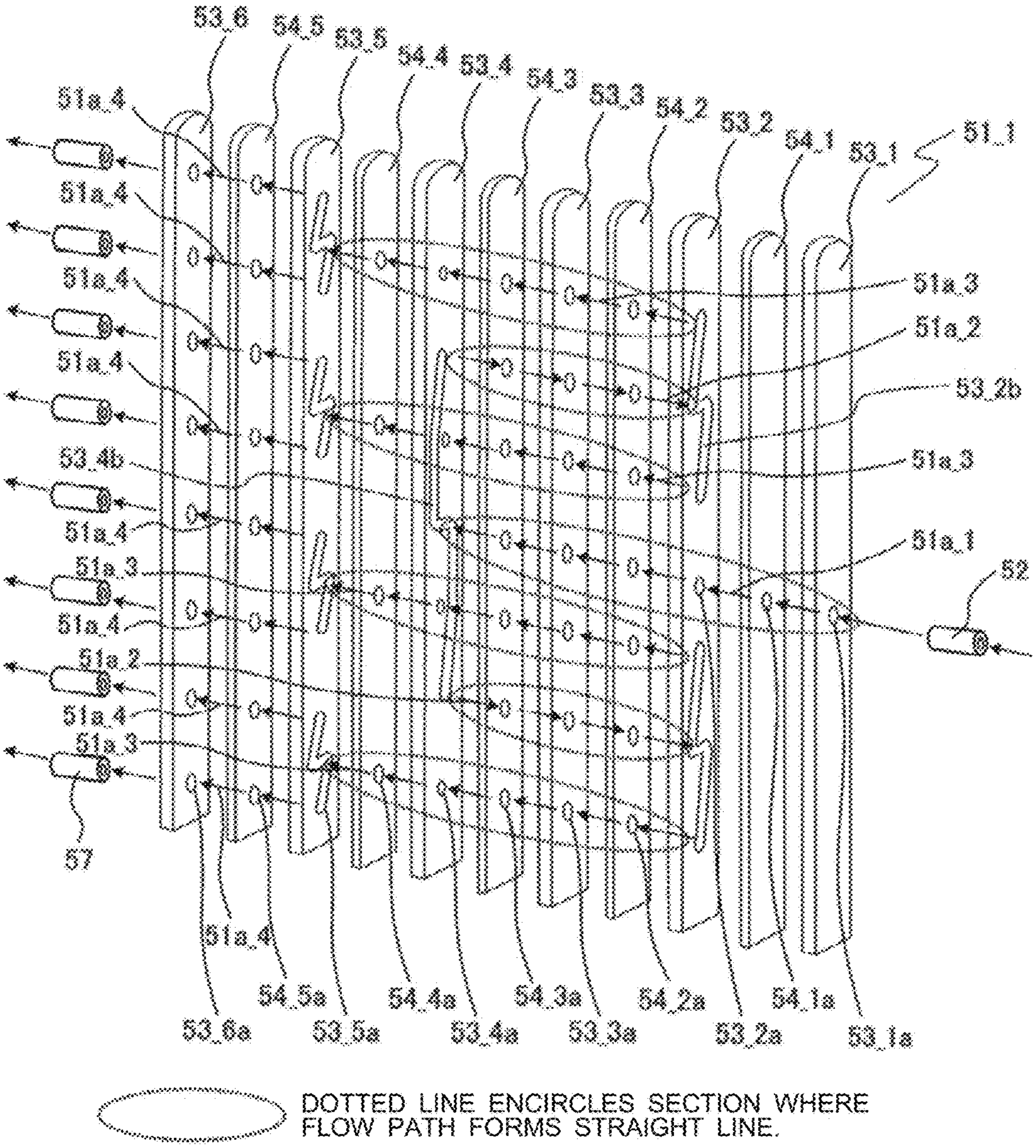
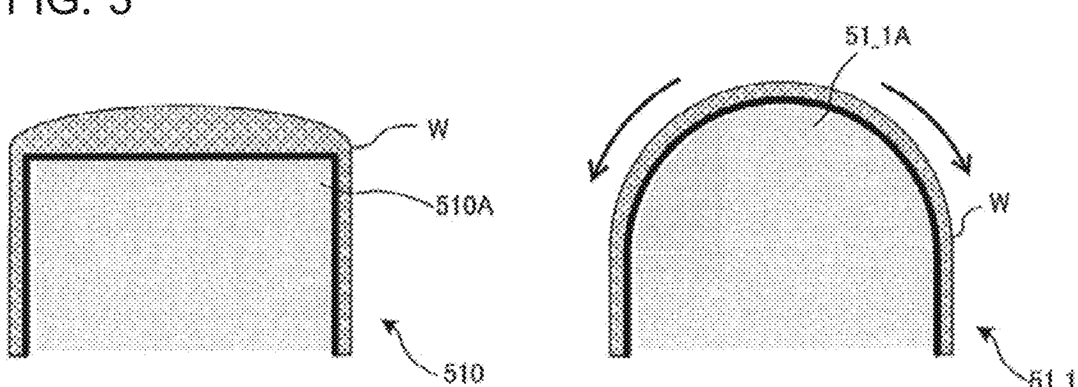


FIG. 3



(a) (b)

Related Art

FIG. 4

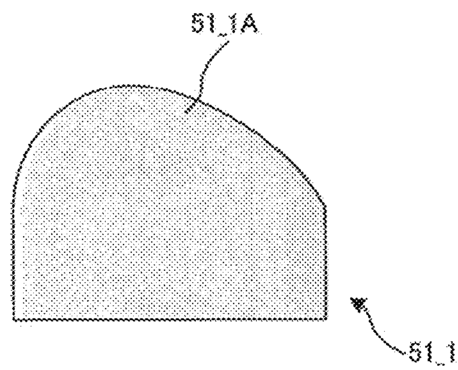


FIG. 5

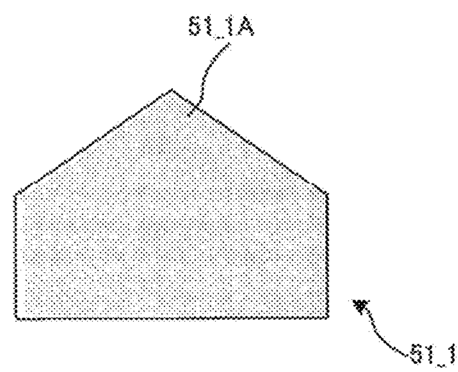


FIG. 6

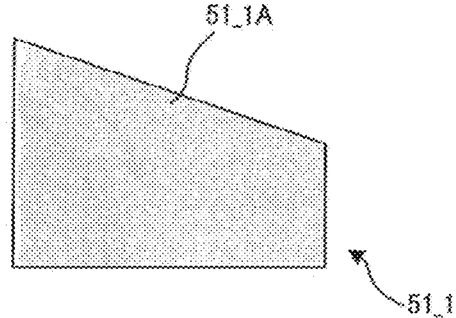


FIG. 7

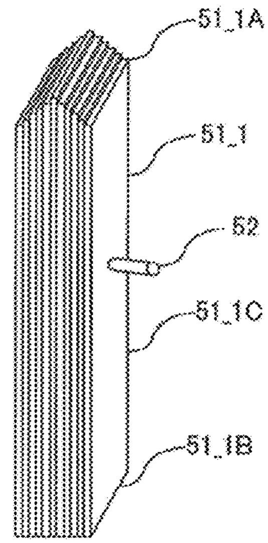


FIG. 8

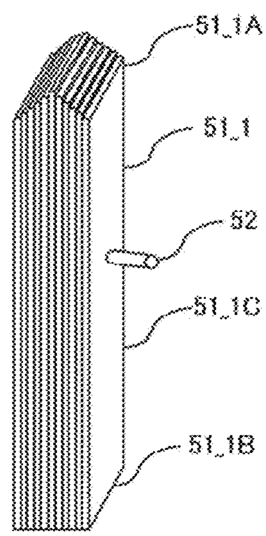


FIG. 9

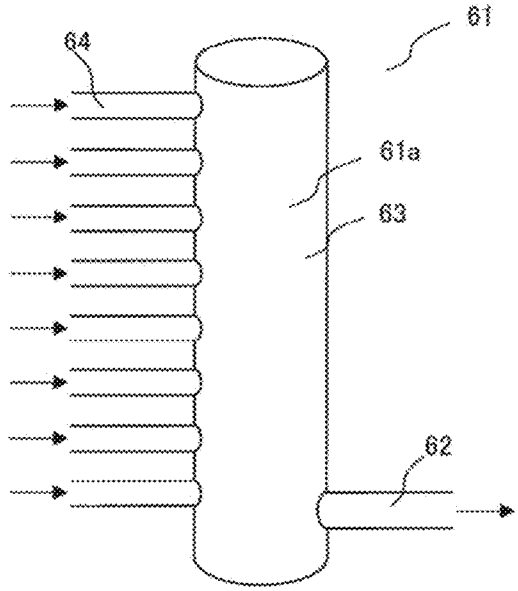

61
64
61a
63
62

FIG. 10

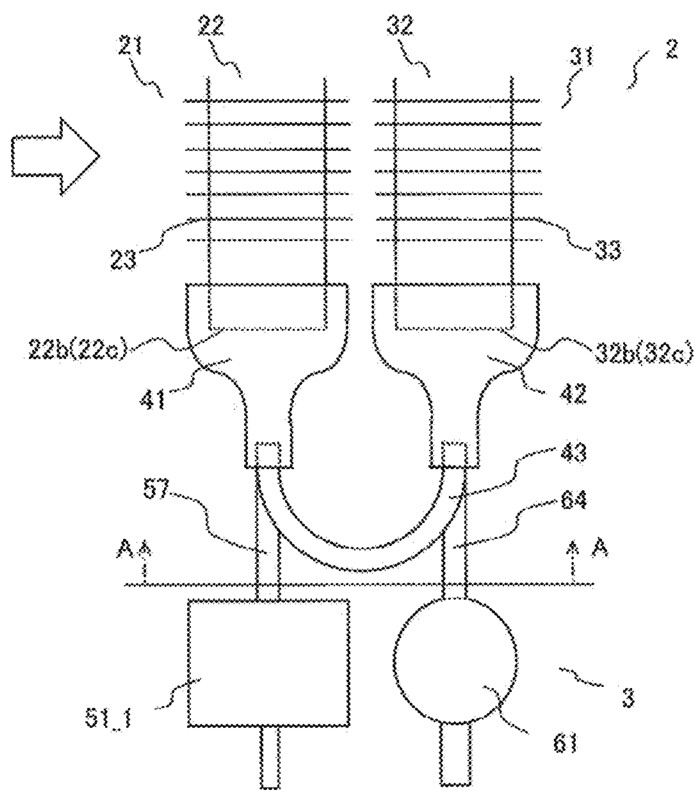

21
22
32
31
2
23
33
22b(22c)
32b(32c)
41
42
43
57
64
A
A
51_1
3
61

FIG. 11

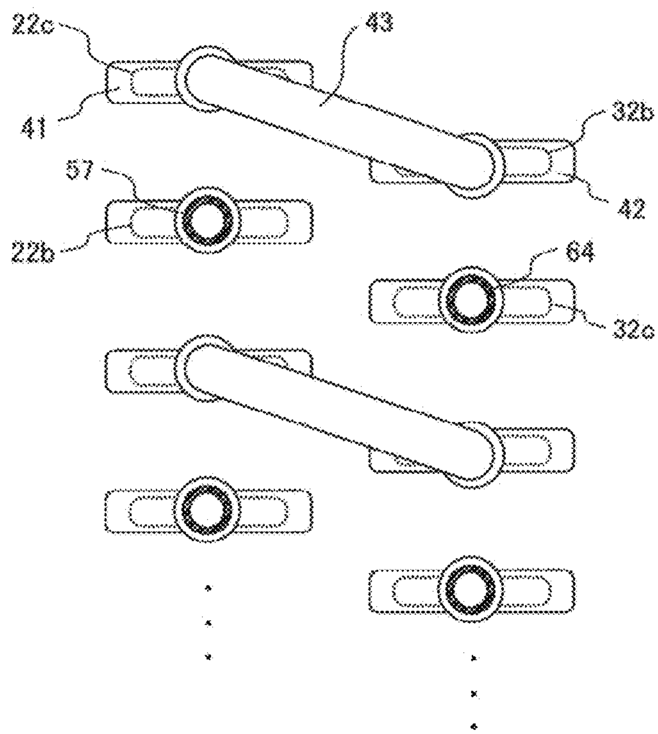

22c
43
41
32b
42
57
22b
64
32c

FIG. 12

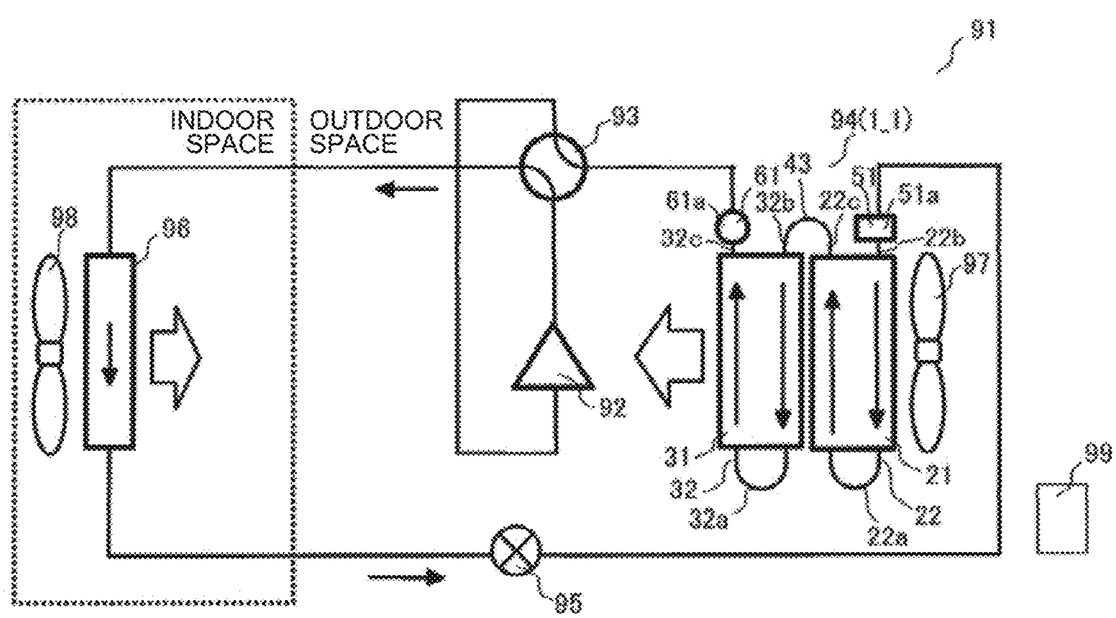

91
INDOOR
SPACE
OUTDOOR
SPACE
93
94(1_1)
61
43
51
61a
32b
22c
51a
32c
22b
98
96
97
92
31
21
32
22
32a
22a
99
95

FIG. 13

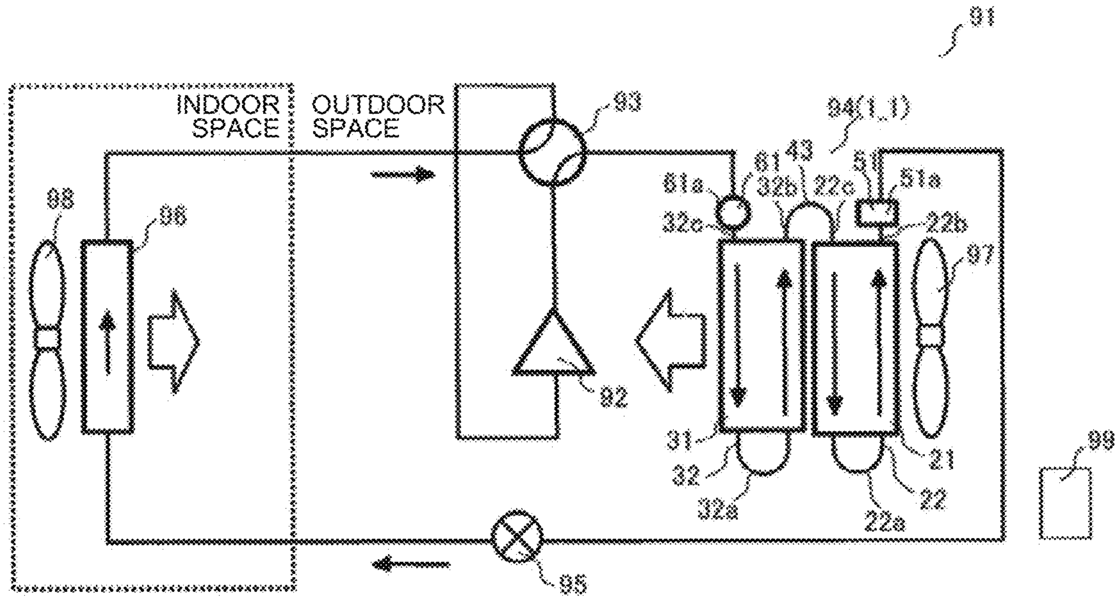

91
INDOOR SPACE
OUTDOOR SPACE
93
94(1_1)
61
43
51
61a
32b
22c
51a
32c
22b
98
96
97
92
31
21
32
22
32a
22a
99
95

FIG. 14

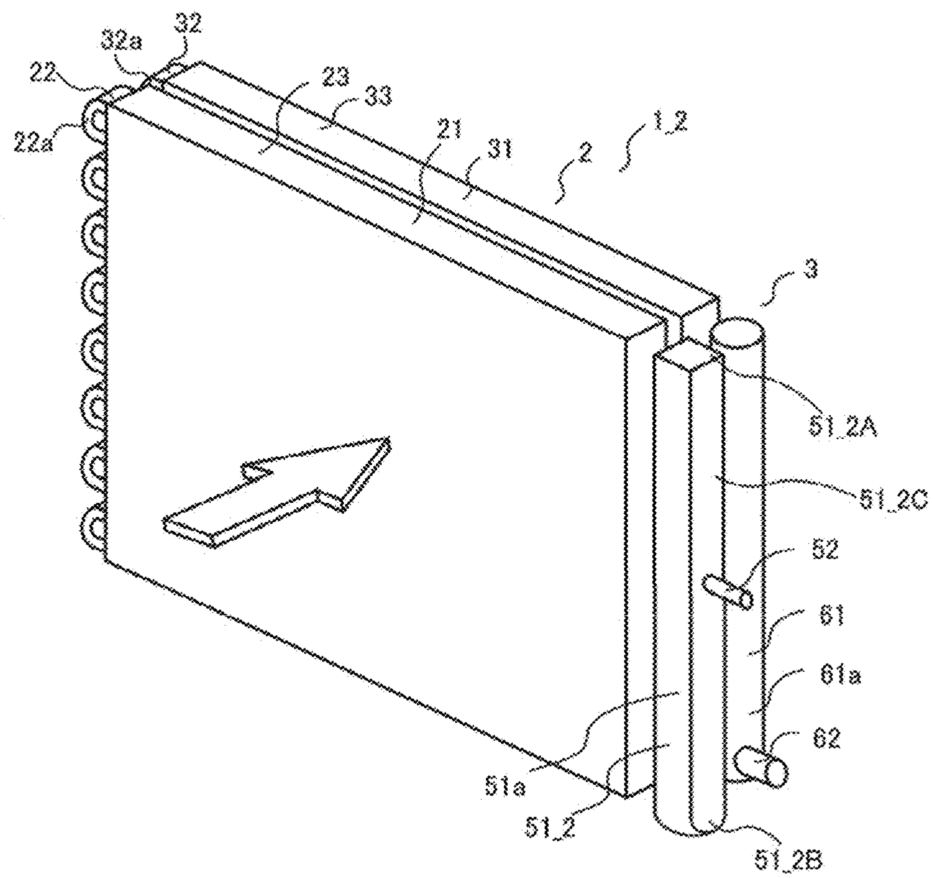

32
32a
22
23
33
22a
21
31
2
1_2
3
51_2A
51_2C
52
61
61a
62
51a
51_2
51_2B

FIG. 15

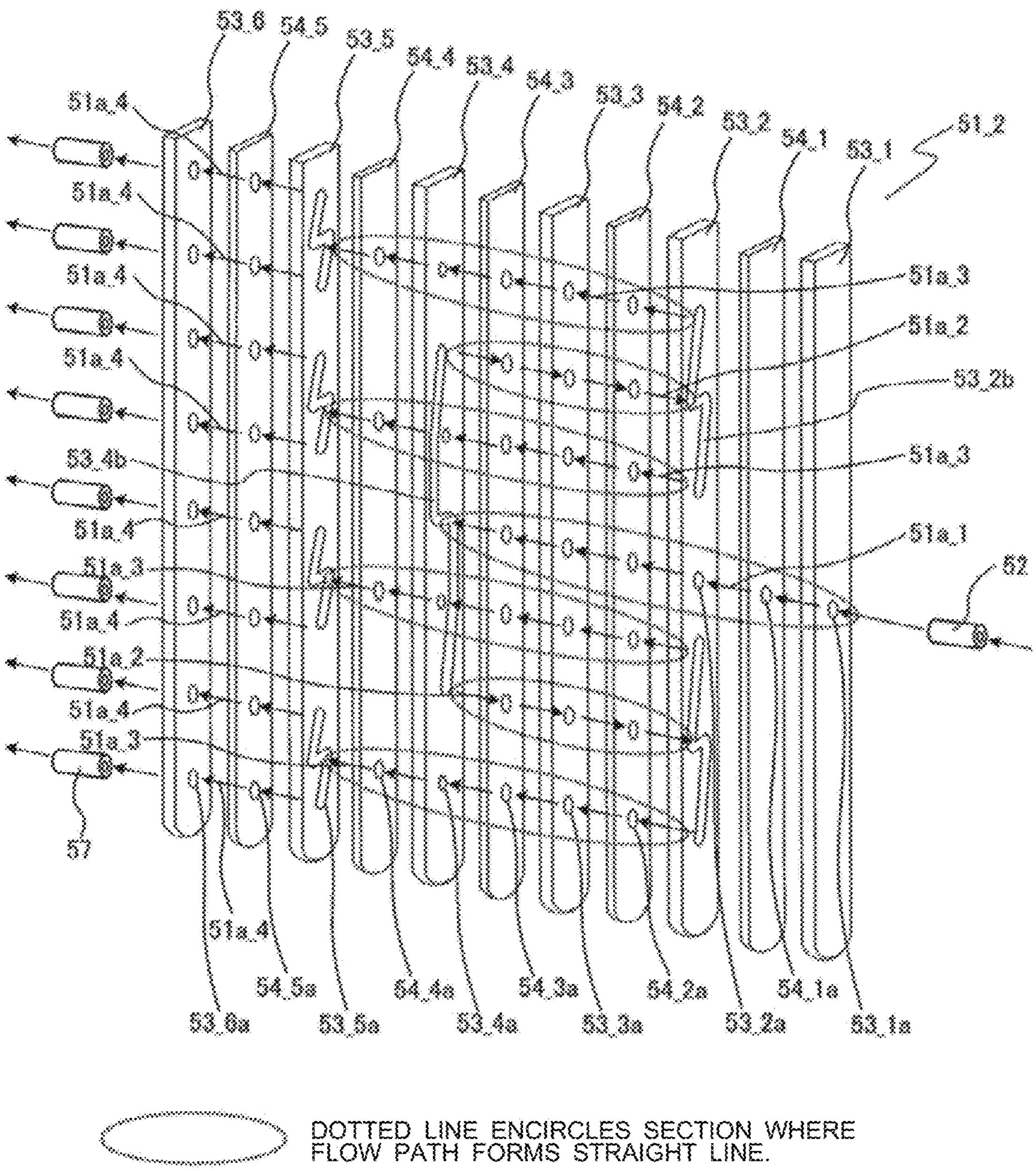
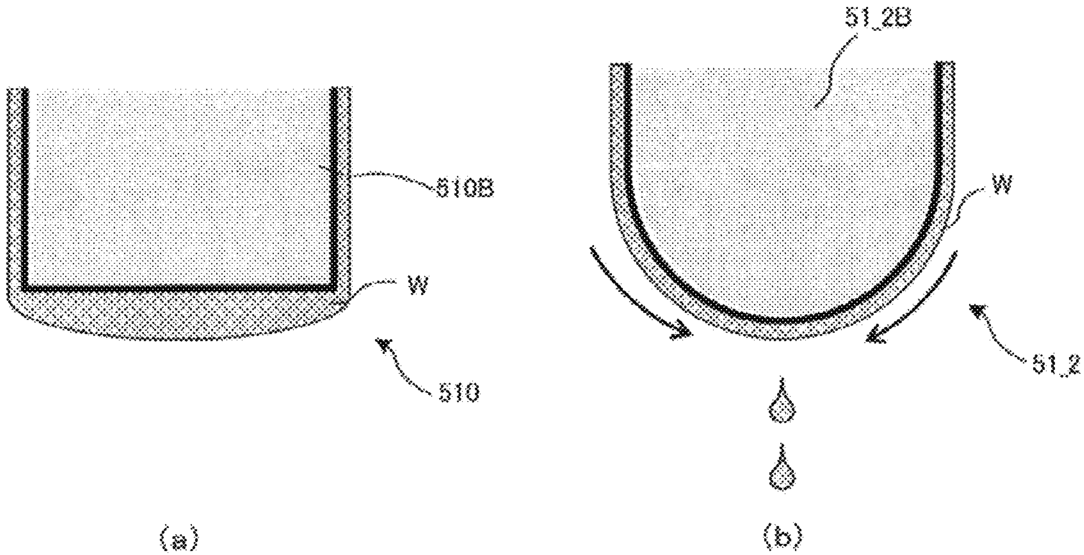
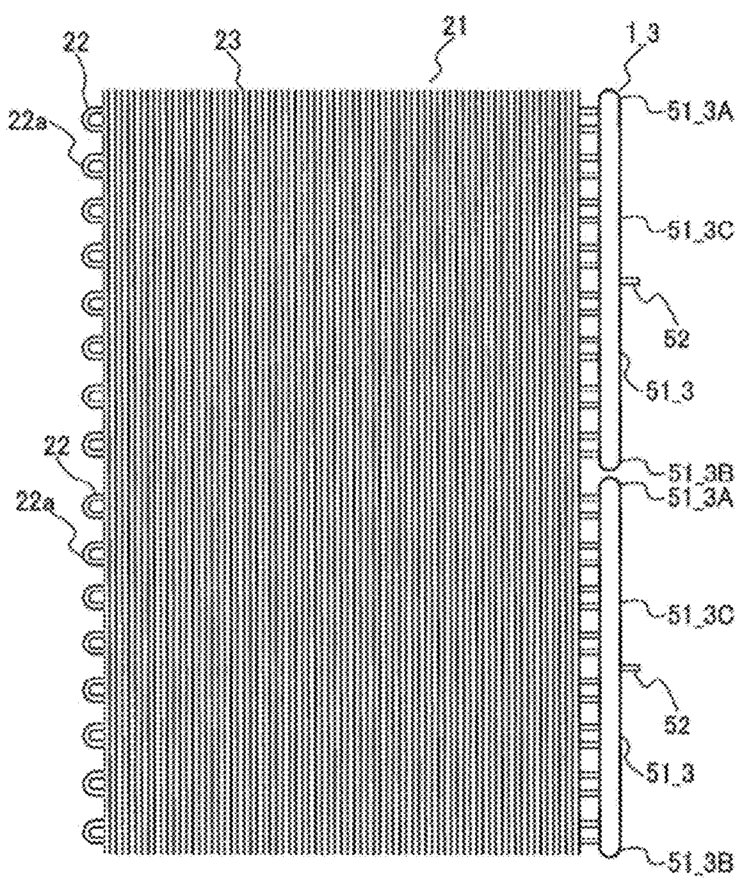

53_6
54_5
53_5
54_4
53_4
54_3
53_3
54_2
53_2
54_1
53_1
51_2
51a_4
51a_3
51a_2
51a_1
53_2b
53_4b
52
57
54_5a
54_4a
54_3a
54_2a
54_1a
53_6a
53_5a
53_4a
53_3a
53_2a
53_1a
DOTTED LINE ENCIRCLES SECTION WHERE FLOW PATH FORMS STRAIGHT LINE.

FIG. 16



Related Art

FIG. 17



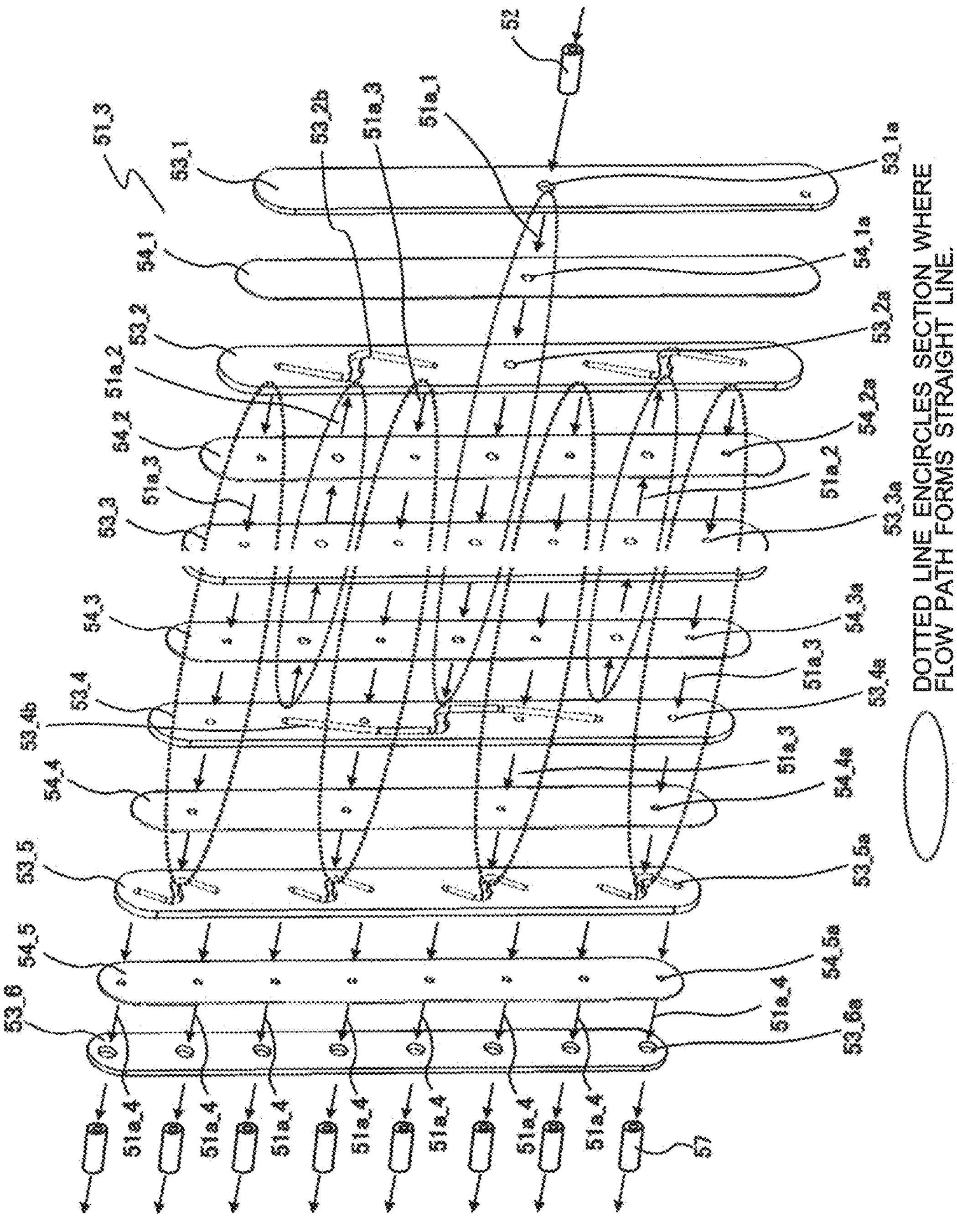
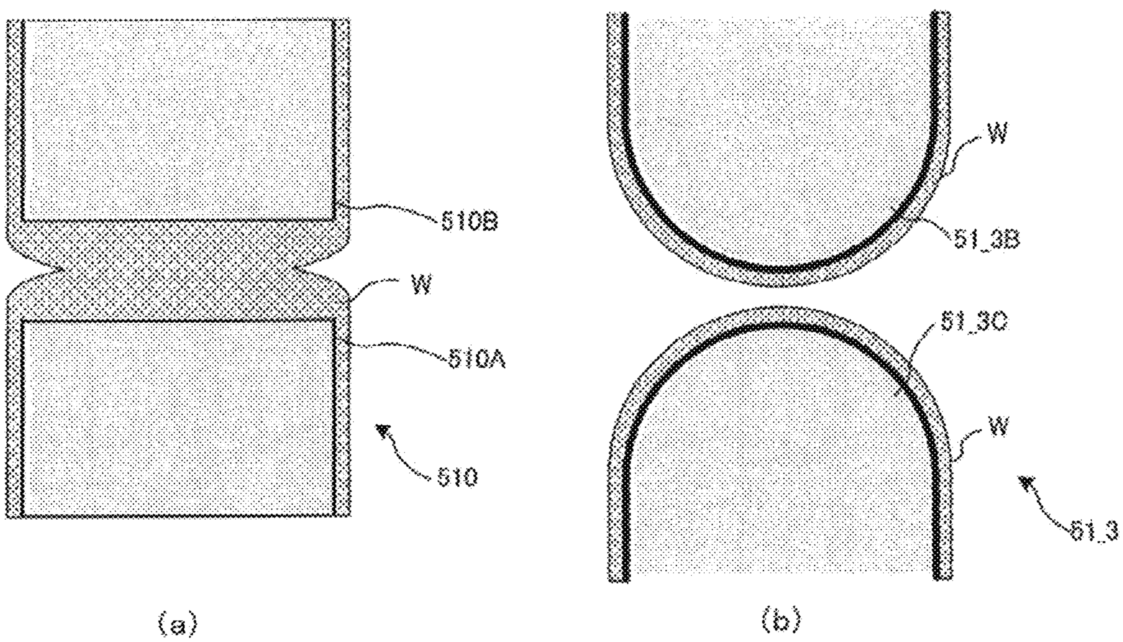

51_3
52
53_1
53_1a
51a_1
51a_3
53_2b
54_1
54_1a
53_2
53_2a
51a_2
54_2
54_2a
51a_3
51a_2
53_3
53_3a
54_3
54_3a
53_4
51a_3
53_4a
53_4b
54_4
51a_3
54_4a
53_5
53_5a
54_5
54_5a
53_6
51a_4
53_6a
51a_4
57
DOTTED LINE ENCIRCLES SECTION WHERE
FLOW PATH FORMS STRAIGHT LINE.

FIG. 18

FIG. 19



Related Art

FIG. 20

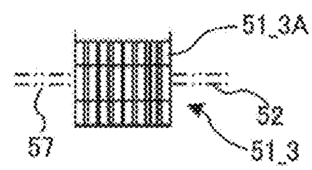


FIG. 21

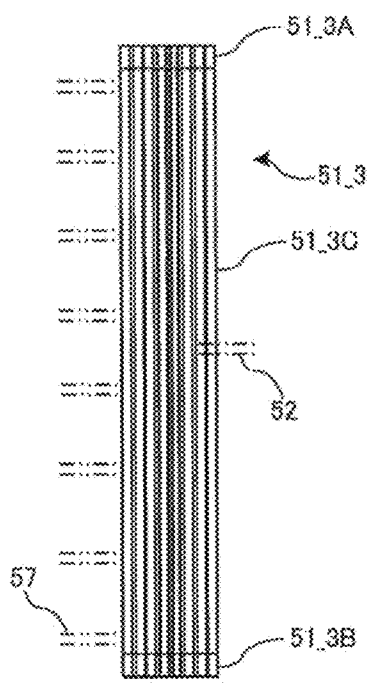


FIG. 22

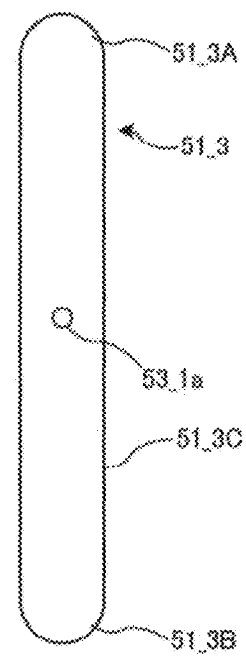
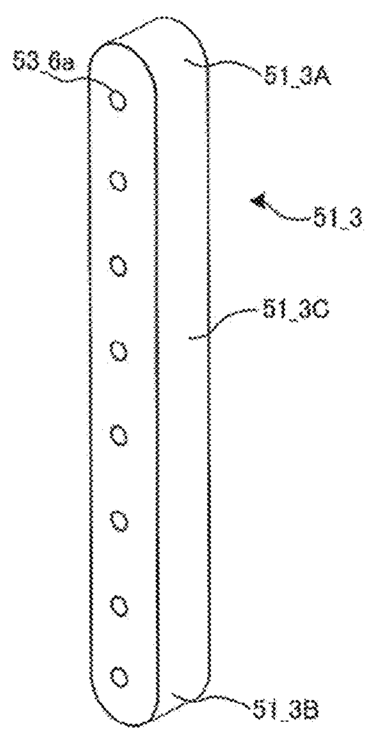


FIG. 23



STACKED HEADER, HEAT EXCHANGER, AND AIR-CONDITIONING APPARATUS

CROSS REFERENCE TO RELATED APPLICATION

This application is a U.S. national stage application of PCT/JP2016/065180 filed on May 23, 2016, the contents of which are incorporated herein by reference.

TECHNICAL FIELD

The present invention relates to a distributor used in a thermal circuit or other devices, a stacked header, a heat exchanger, and an air-conditioning apparatus.

BACKGROUND ART

A heat exchanger includes flow paths (paths) formed by arranging a plurality of heat transfer tubes parallel to one another, for the purpose of alleviating pressure loss of refrigerant flowing through the heat transfer tubes. At refrigerant inlet parts of the heat transfer tubes, a distributor such as a header and a distributing device, for example, configured to evenly distribute the refrigerant to the heat transfer tubes is provided.

To ensure excellent heat transfer performance of the heat exchanger, it is important to evenly distribute the refrigerant to the plurality of heat transfer tubes.

As an example of such a distributor, for example, a distributor has been proposed in which distributing flow paths branching from one inlet flow path into a plurality of outlet flow paths are formed by stacking a plurality of plates together, so that refrigerant can be distributed and supplied to each of the heat transfer tubes of a heat exchanger (see Patent Literature 1, for example).

In a distributor such as one disclosed in Patent Literature 1, an upper end part and a lower end part of the distributor are each a flat face. In the following explanations, the upper end part shaped as a flat face will be referred to as an upper end flat face part, whereas the lower end part shaped as a flat face will be referred to as a lower end flat face part.

CITATION LIST

Patent Literature

Patent Literature 1: international Publication No. WO 2015/063857

SUMMARY OF INVENTION

Technical Problem

While a heat exchanger is being used as an evaporator, moisture in the air adheres to the distributor as condensed water. The condensed water generated on the upper end part of the distributor stagnates at the upper end flat face part of the distributor. When the distributor is manufactured by using a material containing aluminum, the condensed water stagnating at the upper end flat face part of the distributor can be a cause of corrosion of the distributor. Such corrosion of the distributor leads to degradation of reliability of the heat exchanger.

Further, some of the condensed water having flowed downward along the distributor due to the gravity may reach the lower end flat face part of the distributor. In addition, when two or more distributors are installed and arranged in the direction of the gravity, some condensed water may stagnate between the distributors. While the heat exchanger is being used as an evaporator under the condition where the temperature of the outdoor air is low, for example, as low as 2 degrees C., the generated condensed water becomes ice. Because the specific volume of ice is larger than that of water, when the ice grows upward in the gravity direction, the distributor positioned immediately above will be pushed upward. When being pushed up in this manner, the distributor may be deformed. As a result, the heat exchanger may be damaged, and the reliability of the heat exchanger may be degraded.

In view of the problems described above in the background, it is an object of the present invention to provide a distributor, a stacked header, a heat exchanger, and an air-conditioning apparatus that prevent the generated condensed water from stagnating.

Solution to Problem

A distributor according to one embodiment of the present invention is a distributor branching one flow path into a plurality of flow paths, including an upper end part positioned at an upper end of the distributor in a gravity direction, a lower end part positioned at a lower end of the distributor in the gravity direction, and a flow path forming part positioned between the upper end part and the lower end part and having a flow path formed in the flow path forming part. At least one of the upper end part and the lower end part is a non-horizontal face part having a non-horizontal face slanted to a horizontal plane.

A stacked header according to another embodiment of the present invention forms the abovementioned distributor that includes a plurality of plates stacked together.

A heat exchanger according to yet another embodiment of the present invention includes the abovementioned distributor and a plurality of heat transfer tubes connected to the distributor.

An air-conditioning apparatus according to yet another embodiment of the present invention includes the abovementioned heat exchanger.

Advantageous Effects of Invention

In a distributor according to one embodiment of the present invention, at least one of the upper end part and the lower end part is the non-horizontal face part having the non-horizontal face slanted to a horizontal plane. Consequently, water easily falls down, and it is thus possible to prevent the water from stagnating.

A stacked header according to another embodiment of the present invention forms the abovementioned distributor that includes the plurality of plates stacked together. Consequently, the same advantageous effects as those of the abovementioned distributor can be obtained.

A heat exchanger according to yet another embodiment of the present invention includes the abovementioned distributor. Consequently, the heat exchanger is able to prevent water from stagnating and therefore has high reliability.

An air-conditioning apparatus according to yet another embodiment of the present invention includes the abovementioned heat exchanger. Consequently, the air-conditioning apparatus has enhanced reliability, in particular, during heating operations.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a perspective view of a heat exchanger according to Embodiment 1.

FIG. 2 is a perspective view in an exploded state of a stacked header included in the heat exchanger according to Embodiment 1.

FIG. 3 is an explanatory drawing for explaining a water flow in the stacked header included in the heat exchanger according to Embodiment 1 in comparison to that in a conventional example.

FIG. 4 is a schematic drawing of an example of a shape of an upper end part of the stacked header included in the heat exchanger according to Embodiment 1.

FIG. 5 is a schematic drawing of an example of the shape of the upper end part of the stacked header included in the heat exchanger according to Embodiment 1.

FIG. 6 is a schematic drawing of an example of the shape of the upper end part of the stacked header included in the heat exchanger according to Embodiment 1.

FIG. 7 is a schematic drawing of an example of the shape of the upper end part of the stacked header included in the heat exchanger according to Embodiment 1.

FIG. 8 is a schematic drawing of an example of the shape of the upper end part of the stacked header included in the heat exchanger according to Embodiment 1.

FIG. 9 is a perspective view of a cylindrical header included in the heat exchanger according to Embodiment 1.

FIG. 10 is a drawing for explaining connection between a heat exchanging part and a distributing and combining part included in the heat exchanger according to Embodiment 1.

FIG. 11 is a drawing for explaining the connection between the heat exchanging part and the distributing and combining part included in the heat exchanger according to Embodiment 1.

FIG. 12 is a schematic diagram of a configuration of an air-conditioning apparatus in which the heat exchanger according to Embodiment 1 is used.

FIG. 13 is a schematic diagram of the configuration of the air-conditioning apparatus in which the heat exchanger according to Embodiment 1 is used.

FIG. 14 is a perspective view of a heat exchanger according to Embodiment 2.

FIG. 15 is a perspective view in an exploded state of a stacked header included in the heat exchanger according to Embodiment 2.

FIG. 16 is an explanatory drawing for explaining a water flow in the stacked header included in the heat exchanger according to Embodiment 2, in comparison to that in a conventional example.

FIG. 17 is a lateral view of a heat exchanger according to Embodiment 3.

FIG. 18 is a perspective view in an exploded state of any of stacked headers included in the heat exchanger according to Embodiment 3.

FIG. 19 is an explanatory drawing for explaining a water flow in any of the stacked headers included in the heat exchanger according to Embodiment 3, in comparison to that in a conventional example.

FIG. 20 is a plan view of any of the stacked headers included in the heat exchanger according to Embodiment 3.

FIG. 21 is a lateral view of any of the stacked headers included in the heat exchanger according to Embodiment 3.

FIG. 22 is a front view of any of the stacked headers included in the heat exchanger according to Embodiment 3.

FIG. 23 is a perspective view of any of the stacked headers included in the heat exchanger according to Embodiment 3.

DESCRIPTION OF EMBODIMENTS

A distributor, a stacked header, a heat exchanger, and an air-conditioning apparatus according to the present invention will be explained below, with reference to the drawings.

The configurations, operations, and other features explained below are merely examples. Possible embodiments of the distributor, the stacked header, the heat exchanger, and the air-conditioning apparatus according to the present invention are not limited to such configurations, operations, and features explained below. Further, in the drawings, some of the elements that are the same as or similar to one another are referred to by using the same reference signs, or the use of reference signs for such elements is omitted. Further, the illustration of detailed structures in the drawings is either simplified or omitted, as appropriate. Further, duplicate or similar explanations will be either simplified or omitted, as appropriate.

In the following sections, examples will be explained in which the distributor, the stacked header, and the heat exchanger according to the present invention are used in an air-conditioning apparatus; however, possible embodiments are not limited to those of the examples. For example, the distributor, the stacked header, and the heat exchanger according to the present invention may be used in other refrigeration cycle apparatuses each including a refrigerant cycle circuit. Further, although the following describes examples in which the distributor, the stacked header, and the heat exchanger according to the present invention are used in an outdoor heat exchanger of an air-conditioning apparatus, possible embodiments are not limited to those of the examples. The distributor, the stacked header, and the heat exchanger according to the present invention may be used in an indoor heat exchanger of an air-conditioning apparatus. Further, although the following describes the examples in which the air-conditioning apparatus switches between a heating operation and a cooling operation, possible embodiments are not limited to those of the examples. The air-conditioning apparatus may be configured to perform only a heating operation or only a cooling operation.

Embodiment 1

A distributor, a stacked header, a heat exchanger, and an air-conditioning apparatus according to Embodiment 1 will be explained.

<Configuration of Heat Exchanger **1_1**>

The following will describe a schematic configuration of a heat exchanger **1_1** according to Embodiment 1.

FIG. **1** is a perspective view of a heat exchanger **1_1** according to Embodiment 1.

As illustrated in FIG. **1**, the heat exchanger **1_1** includes a heat exchanging part **2** and a distributing and combining part **3**.

<Heat Exchanging Part **2**>

The heat exchanging part **2** includes a windward heat exchanging part **21** provided windward, and a leeward heat exchanging part **31** provided leeward in the passage direction (indicated with the outlined arrow in the drawing) of the air passing through the heat exchanging part **2**. The windward heat exchanging part **21** includes a plurality of windward heat transfer tubes **22** and a plurality of windward fins **23** joined with the plurality of windward heat transfer tubes **22** by, for example, performing a brazing process or other processes. The leeward heat exchanging part **31** includes a plurality of leeward heat transfer tubes **32** and a plurality of leeward fins **33** joined with the plurality of leeward heat transfer tubes **32** by, for example, performing a brazing process or other processes.

FIG. **1** illustrates the example in which the heat exchanging part **2** is structured with the two rows made up of the windward heat exchanging part **21** and the leeward heat exchanging part **31**; however, the heat exchanging part **2** may be structured with three or more rows. In this case, the heat exchanging part **2** may additionally have a heat exchanging part having the same configuration as that of either the windward heat exchanging part **21** or the leeward heat exchanging part **31**.

The windward heat transfer tubes **22** and the leeward heat transfer tubes **32** are each a flat tube, for example, having a plurality of flow paths formed in the flat tube. Each of the plurality of windward heat transfer tubes **22** and the plurality of leeward heat transfer tubes **32** has a corresponding one of a folded part **22***a* and a folded part **32***a*, as a result of a section positioned between one end and the other end of each of the plurality of windward heat transfer tubes **22** and the plurality of leeward heat transfer tubes **32** that is folded in the manner of a hair pin. The windward heat transfer tubes **22** and the leeward heat transfer tubes **32** are arranged on a plurality of levels along the direction intersecting the passage direction (indicated with the outlined arrow in the drawing) of the air passing through the heat exchanging part **2**. The one end and the other end of each of the plurality of windward heat transfer tubes **22** and the plurality of leeward heat transfer tubes **32** face the distributing and combining part **3**.

Each of the windward heat transfer tubes **22** and the leeward heat transfer tubes **32** is not limited to a flat tube and may be a round tube, for example, having a diameter of 4 mm. Further, although the example is explained in which each of the windward heat transfer tubes **22** and the leeward heat transfer tubes **32** is folded in a U-shape to form a corresponding one of the folded part **22***a* and a folded part **32***a*, another arrangement is also acceptable in which the folded parts **22***a* and the folded parts **32***a* are each a separate part of an U-shaped tubes and the flow paths are folded back by connecting the U-shaped tubes each of which has a flow path formed in the U-shaped tube.

<Distributing and Combining Part 3>

The distributing and combining part **3** includes a stacked header **51_1** and a cylindrical header **61**, The stacked header **51_1** and the cylindrical header **61** are arranged next to each another along the passage direction (indicated with the outlined arrow in the drawing) of the air passing through the heat exchanging part **2**, To the stacked header **51_1**, a refrigerant pipe (not illustrated) is connected via a connection pipe **52**. To the cylindrical header **61**, a refrigerant pipe (not illustrated) is connected via a connection pipe **62**. The connection pipe **52** and the connection pipe **62** each may be a round pipe, for example.

On the inside of the stacked header **51_1** serving as a distributor, a distributing and combining flow path **51***a* connected to the windward heat exchanging part **21** is formed. While the heat exchanging part **2** is operating as an evaporator, the distributing and combining flow path **51***a* serves as a distributing flow path that causes the refrigerant flowing in through the refrigerant pipe (not illustrated) to flow out to be distributed to the plurality of windward heat transfer tubes **22** included in the windward heat exchanging part **21**. Further, while the heat exchanging part **2** is operating as a condenser (a radiator), the distributing and combining flow path **51***a* serves as a combining flow path that causes the refrigerant flowing in through the plurality of windward heat transfer tubes **22** included in the windward heat exchanging part **21** to be combined together to flow out to the refrigerant pipe (not illustrated).

On the inside of the cylindrical header **61**, a distributing and combining flow path **61***a* connected to the leeward heat exchanging part **31** is formed. While the heat exchanging part **2** is operating as a condenser (a radiator), the distributing and combining flow path **61***a* serves as a distributing flow path that causes the refrigerant flowing in through the refrigerant pipe (not illustrated) to flow out to be distributed to the plurality of leeward heat transfer tubes **32** included in the leeward heat exchanging part **31**. Further, while the heat exchanging part **2** is operating as an evaporator, the distributing and combining flow path **61***a* serves as a combining flow path that causes the refrigerant flowing in through the plurality of leeward heat transfer tubes **32** included in the leeward heat exchanging part **31** to be combined together to flow out to the refrigerant pipe (not illustrated).

In other words, while the heat exchanging part **2** is operating as an evaporator, the heat exchanger **1_1** has, separately from each other, the stacked header **51_1** having the distributing flow path (the distributing and combining flow path **51***a*) formed in the stacked header **51_1** and the cylindrical header **61** having the combining flow path (the distributing and combining flow path **61***a*) formed in the cylindrical header **61**.

In contrast, while the heat exchanging part **2** is operating as a condenser, the heat exchanger **1_1** has, separately from each other, the cylindrical header **61** having the distributing flow path (the distributing and combining flow path **61***a*) formed in the cylindrical header **61** and the stacked header **51_1** having the combining flow path (the distributing and combining flow path **51***a*) formed in the stacked header **51_1**,

<Configuration of Stacked Header **51_1**>

Next, a configuration of the stacked header **51_1** included in the heat exchanger **1_1** according to Embodiment 1 will be explained.

FIG. **2** is a perspective view in an exploded state of the stacked header **51_1** included in the heat exchanger **1_1** according to Embodiment 1. FIG. **3** is an explanatory drawing for explaining a water flow in the stacked header **51_1** included in the heat exchanger **1_1** according to Embodiment 1 in comparison to that in a conventional example. FIG. **4** to FIG. **8** are schematic drawings of examples of shapes of an upper end part **51_1**A of the stacked header **51_1** included in the heat exchanger **1_1** according to Embodiment 1.

In FIG. **2**, the arrows indicate flows of the refrigerant observed while the distributing and combining flow path **51***a* of the stacked header **51_1** is serving as a distributing flow path.

Further, FIG. **3**(*a*) illustrates an upper end part **510**A of a conventional stacked header **510**, whereas FIG. **3**(*b*) illustrates the upper end part **51_1**A of the stacked header **51_1**.

As illustrated in FIG. **2**, the stacked header **51_1** is formed by stacking together a plurality of first plates **53_1** to **53_6** and a plurality of second plates **54_1** to **54_5** alternately interposed between the first plates **53_1** to **53_6**.

Further, the stacked header **51_1** is attached to the heat exchanging part **2** in such a manner that the longitudinal direction of the stacked header **51_1** extends parallel to the gravity direction.

In the stacked header **51_1**, the upper end part **51_1**A is formed at an upper end of the stacked header **51_1** in the gravity direction, while a lower end part **51_1**B is formed at a lower end of the stacked header **51_1** in the gravity direction. A flow path forming part **51_10** is formed between the upper end part **51_1**A and the lower end part **51_1**B.

The flow path forming part **51_1**C has partial flow paths and distributing and combining flow paths that are formed in the flow path forming part **51_1**C and explained below.

The plurality of first plates **53_1** to **53_6** have partial flow paths **53_1***a* to **53_6***a* formed in the plurality of first plates **53_1** to **53_6**, respectively.

The first plate **53_1** has one partial flow path **53_1***a* formed in the first plate **53_1**.

In addition to one partial flow path **53_2***a*, the first plate **53_2** has two partial flow paths **53_2***b* formed in the first plate **53_2**.

The first plate **53_3** has seven partial flow paths **53_3***a* formed in first plate **53_3**.

In addition to four partial flow paths **53_4***a*, the first plate **53_4** has a partial flow path **53_4***b* formed in the first plate **53_4**.

The first plate **53_5** has four partial flow paths **53_5***a* formed in the first plate **53_5**.

The first plate **53_6** has eight partial flow paths **53_6***a* formed in the first plate **53_6**.

The plurality of second plates **54_1** to **54_5** have partial flow paths **54_1***a* to **54_5***a* formed in the plurality of second plates **54_1** to **54_5**, respectively.

The second plate **54_1** has one partial flow path **54_1***a* formed in the second plate **54_1**.

The second plate **54_2** has seven partial flow paths **54_2***a* formed in the second plate **54_2**.

The second plate **54_3** has seven partial flow paths **54_3***a* formed in the second plate **54_3**.

The second plate **54_4** has four partial flow paths **54_4***a* formed in the second plate **54_4**.

The second plate **54_5** has eight partial flow paths **54_5***a* formed in the second plate **54_5**.

One or both sides of each of the second plates **54_1** to **54_5** are cladded (coated) with a brazing material.

In other words, the first plates **53_1** to **53_6** are stacked together with the second plates **54_1** to **54_5** alternately interposed between the first plates **53_1** to **53_6** and are integrally joined together by a brazing process.

In the following explanations, the plurality of first plates **53_1** to **53_6** and the plurality of second plates **54_1** to **54_5** may collectively be referred to as "plates".

Although the wall thicknesses of the plates and the material used for forming the plates are not particularly limited, it is desirable, for example, to make the wall thickness within the range of approximately 1 mm to 10 mm and to manufacture the plates by using aluminum or copper as a material of the plates.

Further, the plates are processed by performing a pressing process or a cutting process. When the plates are processed by performing a pressing process, a plate of which the thickness is equal to or smaller than 5 mm, which makes the pressing process possible, may be used. When the plates are processed by performing a cutting process, a plate of which the thickness is 5 mm or larger may be used.

Each of the partial flow paths **53_1***a* to **53_4***a* and the partial flow paths **53_6***a* is a through hole and has a circular cross-section.

Each of the partial flow paths **53_5***a*, the partial flow paths **53_2***b*, and the partial flow path **53_4***b* is a linear-shaped (e.g., Z-shaped or S-shaped) penetrating groove of which the height of one end is different from the height of the other end in the gravity direction.

To the partial flow path **53_1***a*, the refrigerant pipe (not illustrated) is connected via the connection pipe **52**.

To each of the partial flow paths **53_6***a*, a different one of the windward heat transfer tubes **22** is connected via a corresponding one of connection pipes **57**.

Each of the connection pipes **57** may be a round pipe, for example.

An alternative arrangement is also acceptable in which each of the partial flow paths **53_6***a* is a through hole shaped to fit the outer circumferential surface of a corresponding one of the windward heat transfer tubes **22**, and the windward heat transfer tubes **22** are directly connected to the through holes without using the connection pipes **57** between the windward heat transfer tubes **22** and the through holes.

The partial flow path **54_1***a* formed in the second plate **54_1** is formed in the position facing the partial flow path **53_1***a* formed in the first plate **53_1**.

The partial flow paths **54_5***a* formed in the second plate **54_5** are formed in the positions facing the partial flow paths **53_6***a* formed in the first plate **53_6**.

The one end and the other end of each of the partial flow paths **53_2***b* formed in the first plate **53_2** are positioned to face corresponding ones of the partial flow paths **54_2***a* formed in the second plate **54_2** that is stacked adjacent to a surface of the first plate **53_2** close to the windward heat exchanging part **21**.

A certain part (e.g., a central part) positioned between the one end and the other end of each of the partial flow paths **53_2***b* formed in the first plate **53_2** is positioned to face a corresponding one of the partial flow paths **54_2***a* formed in the second plate **54_2** that is stacked adjacent to the surface of the first plate **53_2** close to the windward heat exchanging part **21**.

The one end and the other end of the partial flow path **53_4***b* formed in the first plate **53_4** are positioned to face corresponding ones of the partial flow paths **54_2***a* formed in the second plate **54_3** that is stacked adjacent to a surface of the first plate **53_4** far from the windward heat exchanging part **21**.

A certain part (e.g., a central part) positioned between the one end and the other end of the partial flow path **53_4***b* formed in the first plate **53_4** is positioned to face a corresponding one of the partial flow paths **54_2***a* formed in the second plate **54_3** that is stacked adjacent to the surface of the first plate **53_4** far from the windward heat exchanging part **21**.

The one end and the other end of each of the partial flow paths **53_5***a* formed in the first plate **53_5** are positioned to face the partial flow paths **54_5***a* formed in the second plate **54_5** that is stacked adjacent to a surface of the first plate **53_5** close to the windward heat exchanging part **21**.

A certain part (e.g., a central part) positioned between the one end and the other end of each of the partial flow paths **53_5***a* formed in the first plate **53_5** is positioned to face a corresponding one of the partial flow paths **54_4***a* formed in the second plate **54_4** that is stacked adjacent to a surface of the first plate **53_5** far from the windward heat exchanging part **21**.

When the plates are stacked together, the partial flow path **53_1***a*, the partial flow path **54_1***a*, the partial flow path **53_2***a*, one of the partial flow paths **54_2***a*, one of the partial flow paths **53_3***a*, one of the partial flow paths **54_3***a*, and the partial flow path **53_4***b* communicate with one another so that a single flow path, namely, a first distributing and combining flow path **51***a***_1** is formed.

When the plates are stacked together, the partial flow path **53_4***b*, two of the partial flow paths **54_3***a*, two of the partial flow paths **53_3***a*, two of the partial flow paths **54_2***a*, and the partial flow paths **53_2***b* communicate with one another so that two flow paths, namely, second distributing and combining flow paths **51***a***_2** are formed.

When the plates are stacked together, the partial flow paths **53_2***b*, four of the partial flow paths **54_2***a*, four of the partial flow paths **53_3**_a_, four of the partial flow paths **54_4**_a_, and the partial flow paths **53_5**_a_ communicate with one another so that four flow paths, namely, third distributing and combining flow paths **51**_a_**_3** are formed.

When the plates are stacked together, the partial flow paths **53_5**_a_, the partial flow paths **54_5**_a_, and the partial flow paths **53_6**_a_ communicate with one another so that eight flow paths, namely, fourth distributing and combining flow paths **51**_a_**_4** are formed.

<Flows of Refrigerant in Stacked Header **51_1**>

Next, the distributing and combining flow paths and flows of the refrigerant inside the stacked header **51_1** will be explained.

While the refrigerant is flowing in the direction indicated by the arrows in the drawing, the first to the fourth distributing and combining flow paths **51**_a_**_1** to **51**_a_**_4** serve as distributing flow paths. On the other hand, while the refrigerant is flowing in the direction opposite to the direction indicated by the arrows in the drawing, the first to the fourth distributing and combining flow paths **51**_a_**_1** to **51**_a_**_4** serve as combining flow paths.

First, the case in which the first to the fourth distributing and combining flow paths **51**_a_**_1** to **51**_a_**_4** serve as distributing flow paths will be explained.

The refrigerant having flowed into the partial flow path **53_1**_a_ via the connection pipe **52** passes through the first distributing and combining flow path **51**_a_**_1**, flows into a certain part (e.g., the central part) between the one end and the other end of the partial flow path **53_4**_b_, collides with the surface of the second plate **54_4**, and is then divided into two directions, namely upward and downward, in the gravity direction. The refrigerant having been divided into the two flows passes to reach the one end and the other end of the partial flow path **53_4**_b_ and flows into the pair of second distributing and combining flow paths **51**_a_**_2**.

The refrigerant having flowed into the second distributing and combining flow paths **51**_a_**_2** passes straight through the second distributing and combining flow paths **51**_a_**_2**, in the direction opposite to the direction of the refrigerant passing through the first distributing and combining flow path **51**_a_**_1**. This refrigerant collides with the surface of the second plate **54_1** on the inside of the partial flow paths **53_2**_b_ formed in the first plate **53_2** and is then divided into two directions, namely upward and downward, in the gravity direction. The refrigerant having been divided into the two flows passes to reach the one end and the other end of each of the partial flow paths **53_2**_b_ and then flows into the four third distributing and combining flow paths **51**_a_**_3**.

The refrigerant having flowed into the third distributing and combining flow paths **51**_a_**_3** passes straight through the third distributing and combining flow paths **51**_a_**_3**, in the direction opposite to the direction of the refrigerant passing through the second distributing and combining flow paths **51**_a_**_2**, This refrigerant collides with the surface of the second plate **54_5** on the inside of the partial flow paths **53_5**_b_ formed in the first plate **53_5** and is then divided into two directions, namely upward and downward, in the gravity direction. The refrigerant having been divided into the two flows passes to reach the one end and the other end of the third distributing and combining flow paths **51**_a_**_3** and then flows into the eight fourth distributing and combining flow paths **51**_a_**_4**.

The refrigerant having flowed into the fourth distributing and combining flow paths **51**_a_**_4** passes straight through the fourth distributing and combining flow paths **51**_a_**_4**, in the direction opposite to the direction of the refrigerant passing through the third distributing and combining flow paths **51**_a_**_3**, Subsequently, the refrigerant flows out from the fourth distributing and combining flow paths **51**_a_**_4** and flows into the connection pipes **57**.

Next, the case in which the first to the fourth distributing and combining flow paths **51**_a_**_1** to **51**_a_**_4** serve as combining flow paths will be explained.

The refrigerant having flowed into the partial flow paths **53_6**_a_ through the connection pipes **57** passes through the fourth distributing and combining flow paths **51**_a_**_4**, flows into the one end and the other end of each of the partial flow paths **53_5**_a_ and is then combined together, for example, at a central part of each of the partial flow paths **53_5**_a_. The combined refrigerant flows into the third distributing and combining flow paths **51**_a_**_3**. The refrigerant having flowed into the third distributing and combining flow paths **51**_a_**_3** passes straight through the third distributing and combining flow paths **51**_a_**_3**. This refrigerant flows into the one end and the other end of each of the partial flow paths **53_2**_b_ and is then combined together, for example, at a central part of each of the partial flow paths **53_2**_b_. The combined refrigerant flows into the second distributing and combining flow paths **51**_a_**_2** and passes straight through the second distributing and combining flow paths **51**_a_**_2** in the direction opposite to the direction of the refrigerant passing through the third distributing and combining flow paths **51**_a_**_3**.

The refrigerant passing straight through the second distributing and combining flow paths **51**_a_**_2** flows into the one end and the other end of the partial flow path **53_4**_b_ and is then combined together, for example, at a central part of the partial flow path **53_4**_b_. The combined refrigerant flows into the first distributing and combining flow path **51**_a_**_1**. The refrigerant having flowed into the first distributing and combining flow path **51**_a_**_1** passes straight through the first distributing and combining flow path **51**_a_**_1**, in the direction opposite to the direction of the refrigerant passing through the second distributing and combining flow paths **51**_a_**_2**. After that, the refrigerant flows out from the first distributing and combining flow path **51**_a_**_1** and flows into the connection pipe **52**.

In the above paragraphs, the example of the stacked header **51_1** is explained in which the refrigerant is branched eight ways by passing through the branching flow paths three times; however, the number of times of branching is not particularly limited.

Further, the first plates **53_1** to **53_6** may be stacked together directly without having the second plates **54_1** to **54_5** alternately interposed between the first plates **53_1** to **53_6**. When the first plates **53_1** to **53_6** are stacked together with the second plates **54_1** to **54_5** alternately interposed between the first plates **53_1** to **53_6**, the partial flow paths **54_1**_a_ to **54_5**_a_ serve as refrigerant isolating flow paths, and it is thus possible to ensure that the flows of the refrigerant passing through the distributing and combining flow paths are isolated from one another. Alternatively, it is also acceptable to directly stack together plates in each of which a first plate and a second plate stacked adjacent to the first plate are integrally formed.

As illustrated in FIG. **2**, by stacking the plates together, the stacked header **51_1** is assembled.

Incidentally, while the heat exchanger **1_1** is being used as an evaporator, the temperature of the refrigerant flowing through the heat exchanging part **2** is lower than the temperature of the outdoor air. As a result, the surface temperature of the stacked header **51_1** becomes lower than the dew point temperature of the air. Consequently, as illustrated in FIG. **3**, water drops (condensed water W) adhere to the surface of the stacked header **51_1**.

As illustrated in FIG. 3(*a*), in the conventional stacked header **510**, the upper end part **510**A is a horizontal face part. For this reason, the condensed water W adhering to the upper end part **510**A of the stacked header **510** stagnates at the upper end part **510**A and does not flow downward. Because the condensed water W stagnates, the stacked header **510** may be corroded. Also, when the condensed water W freezes, another part (e.g., another stacked header) positioned close to the stacked header **510** may be deformed.

In contrast, as illustrated in FIG. **1**, FIG. **2** and FIG. **3**(*b*), in the stacked header **51_1**, the upper end part **51_1**A is a non-horizontal face part having a non-horizontal face slanted to a horizontal plane. For this reason, even when the condensed water N adheres to the upper end part **51_1**A of the stacked header **51_1**, the condensed water W flows downward along the surface of the upper end part **51_1**A. In particular, because the upper end part **51_1**A is formed to have an arc-shaped cross-section, the condensed water W adhering to the upper end part **51_1**A flows downward along the arc. Thus, the condensed water W can smoothly descend to be discharged, without stagnating at the upper end part **51_1**A. Consequently, by using the stacked header **51_1**, it is possible to prevent the condensed water W from stagnating at the upper end part **51_1**A. It is therefore possible to prevent the stacked header **51_1** from being corroded and to provide the heat exchanger **1_1** having high reliability.

As illustrated in FIG. **2**, by making the upper end of each of the plates have an arc shape, the upper end part **51_1**A having a semi-circular columnar shape is formed as illustrated in FIG. **1**. In other words, the upper end part **51_1**A is formed to have a curved face descending from a centerline of the upper end part **51_1**A extending parallel to the flowing direction of the refrigerant, windward and leeward in the passage direction (indicated with the outlined arrow in the drawing) of the air passing through the heat exchanging part **2**. In other words, the upper end part **51_1**A is formed to have a face descending in the two directions orthogonal to the flowing direction (the flow paths) of the refrigerant, and the flowing direction (the flow paths) serves as the boundary between the two directions.

It should be noted, however, that it is only required that the upper end part **51_1**A is a non-horizontal face part. The apex of the arc-shaped part at the upper end of each of the plates does not necessarily have to be positioned on the centerline of the upper end part **51_1**A extending parallel to the flowing direction of the refrigerant.

For example, it is not necessary to make the upper end of each of the plates have an arc shape in a strict sense. As illustrated in FIG. **4**, it is acceptable to have the apex positioned either windward or leeward.

Further, it is not necessary to form the upper end part **51_1**A as a curved face. As illustrated in FIG. **5**, it is acceptable to form the upper end part **51_1**A as slanted flat faces.

Furthermore, as illustrated in FIG. **6**, it is also acceptable to make the upper end part **51_1**A slanted in one direction, with different heights of the lateral faces of the flow path forming part **51_10**, which are continuous to the upper end part **51_1**A.

Further, as illustrated in FIG. **7**, with different lengths of the plates in the longitudinal direction, it is also acceptable to make the upper end part **51_1**A have a shape descending from a centerline of the upper end part **51_1**A extending parallel to the passage direction (indicated with the outlined arrow in the drawing) of the air passing through the heat exchanging part **2**, windward and leeward in the flowing direction of the refrigerant. In other words, the upper end part **51_1**A is shaped to descend in the flowing directions (the flow paths) of the refrigerant, and a middle part of the flowing directions (the flow paths) of the refrigerant serves as a boundary between the directions.

In this case, it is also possible to imagine that the upper end of each of the plates may have a horizontal plane. However, it is only required that the upper end part **51_1**A is a non-horizontal face part, when the upper end part **51_1**A having been assembled is viewed as a whole.

However, it should be noted that, as illustrated in FIG. **8**, it is possible to better prevent the condensed water W from stagnating, by making the upper end of each of the plates have a curved face or slanted, with different lengths of the plates in the longitudinal direction.

In the stacked header **51_1** having the upper end part **51_1**A illustrated in FIG. **4** to FIG. **6**, the orientation of the upper end part **51_1**A is not limited by either the passage direction (indicated with the outlined arrow in the drawing) of the air passing through the heat exchanging part **2** or the flowing direction of the refrigerant. It is desirable to determine the installation orientation of the upper end part **51_1**A as appropriate, while the flow of the condensed water W is taken into consideration.

Further, the upper end part **51_1**A of the stacked header **51_1** may be formed to have a dome shape. Alternatively, the upper end part **51_1**A of the stacked header **51 _1** may be formed to have a triangular cross-section or an oval cross-section. In other words, it is only required that the upper end part **51_1**A is formed not to have a horizontal face part where the condensed water can stagnate.

<Configuration of Cylindrical Header>

Next, a configuration of the cylindrical header included in the heat exchanger according to Embodiment 1 will be explained.

FIG. **9** is a perspective view of the cylindrical header included in the heat exchanger according to Embodiment 1. In FIG. **9**, the arrows indicate flows of the refrigerant observed while the distributing and combining flow path **61***a* of the cylindrical header **61** is serving as a combining flow path.

As illustrated in FIG. **9**, in the cylindrical header **61**, a circular cylinder part **63** of which one end and the other end are closed is provided in such a manner that the axial direction of the circular cylinder part **63** extends parallel to the gravity direction. However, the axial direction of the circular cylinder part **63** does not necessarily have to extend parallel to the gravity direction. By placing the cylindrical header **61** in such a manner that the axial direction of the circular cylinder part **63** is parallel to the longitudinal direction of the stacked header **51_1**, it is possible to reduce the space required by the distributing and combining part **3**. Alternatively, the circular cylinder part **63** may be a cylinder part having an oval cross-section, for example.

To the lateral wall of the circular cylinder part **63**, the refrigerant pipe (not illustrated) is connected via the connection pipe **62**. To the lateral wall of the circular cylinder part **63**, the leeward heat transfer tubes **32** are connected via a plurality of connection pipes **64**. Each of the connection pipes **64** may be a round pipe, for example. The leeward heat transfer tubes **32** may be directly connected to the lateral wall of the circular cylinder part **63**, without using the connection pipes **64** between the leeward heat transfer tubes **32** and the lateral wall. The circular cylinder part **63** has the distributing and combining flow path **61***a* inside the circular cylinder part **63**. While the refrigerant is flowing in the direction indicated by the arrows in the drawing, the distributing and combining flow path **61***a* serves as a combining flow path. On the other hand, while the refrigerant is flowing in the direction opposite to the direction indicated by the arrows in the drawing, the distributing and combining flow path **61***a* serves as a distributing flow path.

While the distributing and combining flow path **61***a* is serving as a combining flow path, the refrigerant having flowed into the plurality of connection pipes **64** is combined together, by passing through the inside of the circular cylinder part **63** and flowing into the connection pipe **62**. While the distributing and combining flow path **61***a* is serving as a distributing flow path, the refrigerant having flowed into the connection pipe **62** is distributed by passing through the inside of the circular cylinder part **63** and flowing into the plurality of connection pipes **64**.

It is desirable to connect the connection pipe **62** and the plurality of connection pipes **64** in such a manner that, in the circumferential direction of the circular cylinder part **63**, the direction in which the connection pipe **62** is connected and the direction in which the plurality of connection pipes **64** are connected are not along the same straight line. With this arrangement, while the distributing and combining flow path **61***a* is serving as a distributing flow path, it is possible to cause the refrigerant to flow into the plurality of connection pipes **64** more evenly.

<Connection Between Heat Exchanging Part **2** and Distributing and Combining Part **3**>

Next, the connection between the heat exchanging part **2** and the distributing and combining part **3** included in the heat exchanger **1_1** according to Embodiment 1 will be explained.

FIG. **10** and FIG. **11** are drawings for explaining the connection between the heat exchanging part and the distributing and combining part included in the heat exchanger according to Embodiment 1. FIG. **11** is a cross-sectional view taken along line A-A in FIG. **10**.

As illustrated in FIG. **10** and FIG. **11**, a windward joint part **41** is joined to each of one end **22***b* and the other end **22***c* of each of the windward heat transfer tubes **22** each formed to have a substantially U-shape. A flow path is formed on the inside of the windward joint part **41**. One end of the flow path is formed to fit the outer circumferential surface of the windward heat transfer tube **22**, whereas the other end of the flow path has a circular shape.

Similarly, a leeward joint part **42** is joined to each of one end **32***b* and the other end **32***c* of each of the leeward heat transfer tubes **32** each formed to have a substantially U-shape. A flow path is formed on the inside of the leeward joint part **42**. One end of the flow path is formed to fit the outer circumferential surface of the leeward heat transfer tube **32**, whereas the other end of the flow path has a circular shape.

Each of the windward joint parts **41** joined to the other end **22***c* of a corresponding one of the windward heat transfer tubes **22** is connected, via a liaison pipe **43**, to a corresponding one of the leeward joint parts **42** joined to the one end **32***b* of a corresponding one of the leeward heat transfer tubes **32**. The liaison pipe **43** may be a round pipe bent in an arc shape, for example. To each of the windward joint parts **41** joined to the one end **22***b* of a corresponding one of the windward heat transfer tubes **22**, a corresponding one of the connection pipes **57** of the stacked header **51_1** is connected. To each of the leeward joint parts **42** joined to the other end **32***c* of a corresponding one of the leeward heat transfer tubes **32**, a corresponding one of the connection pipes **64** of the cylindrical header **61** is connected.

Alternatively, each of the windward joint parts **41** and a corresponding one of the connection pipes **57** may be integrally formed. Further, each of the leeward joint parts **42** and a corresponding one of the connection pipes **64** may be integrally formed. Also, each of the windward joint parts **41**, a corresponding one of the leeward joint parts **42**, and a corresponding one of the liaison pipes **43** may be integrally formed.

<Configuration of Air-Conditioning Apparatus **91** in which Heat Exchanger **1_1** is used>

Next, a configuration of the air-conditioning apparatus **91** in which the heat exchanger **1_1** according to Embodiment 1 is used will be explained.

FIG. **12** and FIG. **13** are schematic diagrams of the configuration of the air-conditioning apparatus **91** in which the heat exchanger **1_1** according to Embodiment 1 is used. FIG. **12** illustrates a flow of the refrigerant observed while the air-conditioning apparatus **91** is performing a heating operation. FIG. **13** illustrates a flow of the refrigerant observed while the air-conditioning apparatus **91** is performing a cooling operation.

As illustrated in FIG. **12** and FIG. **13**, the air-conditioning apparatus **91** includes a compressor **92**, a four-way valve **93**, an outdoor heat exchanger (a heat source side heat exchanger) **94**, an expansion device **95**, an indoor heat exchanger (a load side heat exchanger) **96**, an outdoor fan (a heat source side fan) **97**, an indoor fan (a load side fan) **98**, and a controller **99**. The compressor **92**, the four-way valve **93**, the outdoor heat exchanger **94**, the expansion device **95**, and the indoor heat exchanger **96** are connected together by refrigerant pipes to form a refrigerant cycle circuit. Alternatively, the four-way valve **93** may be another flow path switching device such as a two-way valve, a three-way valve, and a device combining these valves as appropriate.

The outdoor heat exchanger **94** is the heat exchanger **1_1** illustrated in FIG. **1** to FIG. **11**. The heat exchanger **1_1** is installed in such a manner that the stacked header **51_1** is provided windward and the cylindrical header **61** is provided leeward in the airflow generated by driving of the outdoor fan **97**. The outdoor fan **97** may be provided windward of the heat exchanger **1_1** or may be provided leeward of the heat exchanger **1_1**.

To the controller **99**, for example, the compressor **92**, the four-way valve **93**, the expansion device **95**, the outdoor fan **97**, the indoor fan **98**, various types of sensors, and other elements are connected. The controller **99** switches between the heating operation and the cooling operation by switching the flow paths of the four-way valve **93**.

<Operations of Heat Exchanger **1_1** and Air-Conditioning Apparatus **91**>

Next, operations of the heat exchanger **1_1** according to Embodiment 1 and the air-conditioning apparatus **91** in which the heat exchanger **1_1** is used will be explained.

<Operations of Heat Exchanger **1_1** and Air-Conditioning Apparatus **91** During Heating Operation>

Next, a flow of the refrigerant observed during the heating operation will be explained, with reference to FIG. **12**.

The refrigerant having high pressure and high temperature and being in a gas state is discharged from the compressor **92**, flows into the indoor heat exchanger **96** via the four-way valve **93**, is condensed by exchanging heat with the air supplied by the indoor fan **98**, and thus heats the inside of a room. The refrigerant having been condensed by the indoor heat exchanger **96** is brought into a subcooled liquid state having high pressure, flows out of the indoor heat exchanger **96**, and is caused by the expansion device **95** to be refrigerant in a two-phase gas-liquid state having low pressure.

The refrigerant brought into the two-phase gas-liquid state having low pressure by the expansion device **95** flows into the outdoor heat exchanger **94**, exchanges heat with the air supplied by the outdoor fan **97**, and evaporates. The refrigerant having been evaporated by the outdoor heat exchanger **94** is brought into a superheated gas state having low pressure, flows out of the outdoor heat exchanger **94**, and is sucked into the compressor **92** via the four-way valve **93**. In other words, during the heating operation, the outdoor heat exchanger **94** operates as an evaporator.

In the outdoor heat exchanger **94**, the refrigerant flows in to be distributed to the distributing and combining flow path **51***a* of the stacked header **51_1** and flows into the one end **22***b* of each of the windward heat transfer tubes **22** included in the windward heat exchanging part **21**. The refrigerant having flowed into the one end **22***b* of each of the windward heat transfer tubes **22** passes through a corresponding one of the folded parts **22***a*, reaches the other end **22***c* of each of the windward heat transfer tubes **22**, and flows into the one end **32***b* of each of the leeward heat transfer tubes **32** included in the leeward heat exchanging part **31** via each of the liaison pipes **43**. The refrigerant having flowed into the one end **32***b* of each of the leeward heat transfer tubes **32** passes through a corresponding one of the folded parts **32***a*, reaches the other end **32***c* of each of the leeward heat transfer tubes **32**, and is combined together to flow into the distributing and combining flow path **61***a* of the cylindrical header **61**.

While the outdoor heat exchanger **94** is being used as an evaporator, the temperature of the refrigerant may become lower than the temperature of the outdoor air. As a result, the surface temperature of the stacked header **51_1** becomes lower than the dew point temperature of the air, and water drops (condensed water) adhere to the surface of the stacked header **51_1**. Because the upper end part **51_1**A of the stacked header **51_1** is the non-horizontal face part, the condensed water generated at the upper end part **51_1**A of the stacked header **51_1** flows downward along the surface of the upper end part **51_1**A of the stacked header **51_1**. Consequently, the condensed water smoothly descends without stagnating at the upper end part **51_1**A of the stacked header **51_1**.

Consequently, it is possible to prevent the condensed water from stagnating at the upper end part **51_1**A of the stacked header **51_1**. It is therefore possible to prevent the stacked header **51_1** from being corroded by a long-term stagnation of the condensed water. Consequently, it is therefore possible to provide the heat exchanger **1_1** having high reliability.

<Operations of Heat Exchanger **1_1** and Air-Conditioning Apparatus **91** During Cooling Operation>

Next, a flow of the refrigerant observed during the cooling operation will be explained, with reference to FIG. **13**.

The refrigerant having high pressure and high temperature and being in a gas state is discharged from the compressor **92**, flows into the outdoor heat exchanger **94** via the four-way valve **93**, and is condensed by exchanging heat with the air supplied by the outdoor fan **97**. The refrigerant having been condensed by the outdoor heat exchanger **94** is brought into a subcooled liquid state having high pressure (or a two-phase gas-liquid state having low quality), flows out of the outdoor heat exchanger **94**, and is caused by the expansion device **95** to be in a two-phase gas-liquid state having low pressure.

The refrigerant brought into the two-phase gas-liquid state having low pressure by the expansion device **95** flows into the indoor heat exchanger **96**, is evaporated by exchanging heat with the air supplied by the indoor fan **98**, and thus cools the inside of the room. The refrigerant having been evaporated by the indoor heat exchanger **96** is brought into a superheated gas state having low pressure, flows out of the indoor heat exchanger **96**, and is sucked into the compressor **92** via the four-way valve **93**. In other words, during the cooling operation, the outdoor heat exchanger **94** operates as a condenser.

In the outdoor heat exchanger **94**, the refrigerant flows in to be distributed to the distributing and combining flow path **61***a* of the cylindrical header **61** and flows into the other end **32***c* of each of the leeward heat transfer tubes **32** included in the leeward heat exchanging part **31**. The refrigerant having flowed into the other end **32***c* of each of the leeward heat transfer tubes **32** passes through a corresponding one of the folded parts **32***a*, reaches the one end **32***b* of each of the leeward heat transfer tubes **32**, and flows into the other end **22***c* of each of the windward heat transfer tubes **22** included in the windward heat exchanging part **21**, via the liaison pipes **43**. The refrigerant having flowed into the other end **22***c* of each of the windward heat transfer tubes **22** passes through a corresponding one of the folded parts **22***a*, reaches the one end **22***b* of each of the windward heat transfer tubes **22**, and is combined together to flow into the distributing and combining flow path **51***a* of the stacked header **51_1**.

In Embodiment 1, the stacked header **51_1** is explained as an example of the distributor; however, the structure of the upper end part **51_1**A described in Embodiment 1 is also applicable to flow paths of distributors and distributing devices using pipes having a more commonly-used configuration.

Embodiment 2

A distributor, a stacked header, a heat exchanger, and an air-conditioning apparatus according to Embodiment 2 will be explained.

<Configuration of Heat Exchanger **1_2**>

In the following sections, a schematic configuration of a heat exchanger **1_2** according to Embodiment 2 will be explained.

FIG. **14** is a perspective view of the heat exchanger **1_2** according to Embodiment 2.

Embodiment 2 will be explained while a focus is placed on differences from Embodiment 1. Some of the parts being the same as those in Embodiment 1 will be referred to by using the same reference signs, and the explanations of the parts will be omitted.

In a stacked header **51_2**, an upper end part **51_2**A is formed at an upper end of the stacked header **51_2** in the gravity direction, while a lower end part **51_2**B is formed at a lower end of the stacked header **51_2** in the gravity direction. A flow path forming part **51_20** is formed between the upper end part **51_2**A and the lower end part **51_2**B.

The flow path forming part **51_20** has the partial flow paths and the distributing and combining flow paths that are formed in the flow path forming part **51_20** and explained in Embodiment 1.

In Embodiment 1, the example is explained in which the upper end part **51_1**A of the stacked header **51_1** is the non-horizontal face part. In Embodiment 2, the shapes of the upper end part **51_2**A and the lower end part **51_2**B of the stacked header **51_2** are different from those in Embodiment 1. Because the other configurations are the same as those of the distributor, the stacked header **51_1**, the heat exchanger **1_1**, and the air-conditioning apparatus **91** according to Embodiment 1, the explanations of the other configurations will be omitted.

In other words, in the heat exchanger **1_2** according to Embodiment 2, the upper end part **51_2**A of the stacked header **51_2** is a horizontal face part, while the lower end part **51_2**B is a non-horizontal face part having a non-horizontal face slanted to a horizontal plane.

<Configuration of Stacked Header **51_2**>

Next, a configuration of the stacked header **51_2** included in the heat exchanger **1_2** according to Embodiment 2 will be explained.

FIG. **15** is a perspective view in an exploded state of the stacked header **51_2** included in the heat exchanger **1_2** according to Embodiment 2. FIG. **16** is an explanatory drawing for explaining a water flow in the stacked header **51_2** included in the heat exchanger **1_2** according to Embodiment 2, in comparison to that in a conventional example.

In FIG. **15**, the arrows indicate flows of the refrigerant observed while the distributing and combining flow path **51***a* of the stacked header **51_2** is serving as a distributing flow path.

FIG. **16**(*a*) illustrates a lower end part **510**E of the conventional stacked header **510**, whereas FIG. **16**(*b*) illustrates a lower end part **51_2**B of the stacked header **51_2**.

As illustrated in FIG. **15**, similarly to the stacked header **51_1** according to Embodiment 1, the stacked header **51_2** is formed by stacking together the plurality of first plates **53_1** to **53_6** and the plurality of second plates **54_1** to **54_5** alternately interposed between the first plates **53_1** to **53_6**.

Further, the stacked header **51_2** is attached to the heat exchanging part **2** in such a manner that the longitudinal direction of the stacked header **51_2** extends parallel to the gravity direction. In the stacked header **51_2**, the upper end part **51_2**A is formed at the upper end of the stacked header **51_2** in the gravity direction, whereas the lower end part **51_2**B is formed at the lower end of the stacked header **51_2** in the gravity direction.

The configurations other than the upper end and the lower end of each of the plates, the partial flow paths formed in the plates, and the distributing and combining flow paths formed as a result of stacking the plates together are the same as those in the stacked header **51_1** according to Embodiment 1.

Further, the flows of the refrigerant in the stacked header **51_2** are also the same as those in the stacked header **51_1** according to Embodiment 1.

As illustrated in FIG. **15**, as a result of stacking the plates together, the stacked header **51_2** is assembled.

Incidentally, while the heat exchanger **1_2** is being used as an evaporator, the temperature of the refrigerant flowing through the heat exchanging part **2** is lower than the temperature of the outdoor air. As a result, the surface temperature of the stacked header **51_2** becomes lower than the dew point temperature of the air. Consequently, as illustrated in FIG. **16**, water drops (condensed water W) adhere to the surface of the stacked header **51_2**.

As illustrated in FIG. **16**(*a*), in the conventional stacked header **510**, the lower end part **510**E is a horizontal face part. For this reason, the condensed water W adhering to the lower end part **510**B of the stacked header **510** stagnates at the lower end part **510**B due to surface tension and does not easily flow downward. Because the condensed water W stagnates, the stacked header **510** may be corroded. Also, when the condensed water W freezes, another part (e.g., another stacked header) positioned close to the stacked header **510** may be deformed.

In contrast, as illustrated in FIG. **14**, FIG. **15**, and FIG. **16**(*b*), in the stacked header **51_2**, the lower end part **51_2**B is a non-horizontal face part. For this reason, even when the condensed water W adheres to the lower end part **51_2**B of the stacked header **51_2**, the condensed water W flows downward along the surface of the lower end part **51_2**B. In particular, because the lower end part **51_2**B is formed to have an arc shape, the condensed water W adhering to the lower end part **51_26** flows downward along the arc, is collected, and descends. Consequently, the condensed water W smoothly can descend to be discharged, without stagnating at the lower end part **51_2**B. As a result, by using the stacked header **51_2**, it is possible to prevent the condensed water W from stagnating at the lower end part **51_2**B. It is therefore possible to prevent the stacked header **51_2** from being corroded. Consequently, it is possible to provide the heat exchanger **1_2** having high reliability.

As illustrated in FIG. **15**, by making the lower end of each of the plates have an arc shape, the lower end part **51_26** having a semi-circular columnar shape is formed as illustrated in FIG. **14**. In other words, the lower end part **51_2**B is formed to have a curved face descending from a centerline of the lower end part **51_26** extending parallel to the flowing direction of the refrigerant, windward and leeward in the passage direction (indicated with the outlined arrow in the drawing) of the air passing through the heat exchanging part **2**.

It should be noted, however, that it is only required that the lower end part **51_2**B is a non-horizontal face part. The apex of the arc-shaped part at the upper end of each of the plates does not necessarily have to be positioned on the centerline of the lower end part **51_26** extending parallel to the flowing direction of the refrigerant.

For example, it is acceptable to adopt any of the shapes illustrated in FIG. **4** to FIG. **8** explained in Embodiment 1 as the shape of the lower end part **51_26** of the stacked header **51_2**.

Further, the heat exchanger **1_2** according to Embodiment 2 may be installed as the outdoor heat exchanger **94** into the air-conditioning apparatus **91** according to Embodiment 1.

Further, while the outdoor heat exchanger **94** is being used as an evaporator, the temperature of the refrigerant may become lower than the temperature of the outdoor air. As a result, the surface temperature of the stacked header **51_2** becomes lower than the dew point temperature of the air, and water drops (condensed water) adhere to the surface of the stacked header **51_2**. Because the lower end part **51_2**B of the stacked header **51_2** is the non-horizontal face part, the condensed water generated at the lower end part **51_2**B of the stacked header **51_2** flows downward along the surface of the lower end part **51_2**B of the stacked header **51_2**, is collected, and descends. In this manner, the condensed water smoothly descends without stagnating at the lower end part **51_2**B of the stacked header **51_2**.

Consequently, it is possible to prevent the condensed water from stagnating at the lower end part **51_2**B of the stacked header **51_2**. It is therefore possible to prevent the stacked header **51_2** from being corroded by a long-term stagnation of the condensed water. Consequently, it is possible to provide the heat exchanger **1_2** having high reliability.

Further, because the lower end part **51_2**B is the non-horizontal face part, it is possible to easily recognize the orientation in the up-and-down directions when the heat exchanger **1_2** is installed. It is therefore possible to save trouble in management and to improve efficiency during the manufacturing procedure.

In Embodiment 2, the stacked header **51_2** is explained as an example of the distributor; however, the structure of the lower end part **51_2**B described in Embodiment 2 is also applicable to flow paths of distributors and distributing devices using pipes having a more commonly-used configuration.

Embodiment 3

A distributor, a stacked header, a heat exchanger, and an air-conditioning apparatus according to Embodiment 3 will be explained.

<Configuration of Heat Exchanger **1_3**>

In the following sections, a schematic configuration of a heat exchanger **1_3** according to Embodiment 3 will be explained.

FIG. **17** is a lateral view of the heat exchanger **1_3** according to Embodiment 3.

Embodiment 3 will be explained while a focus is placed on differences from Embodiments 1 and 2. Some of the parts being the same as those in Embodiments 1 and 2 will be referred to by using the same reference signs, and the explanations of the parts will be omitted.

In the stacked header **51_3**, an upper end part **51_3**A is formed at an upper end of the stacked header **51_3** in the gravity direction, while a lower end part **51_3**B is formed at a lower end of the stacked header **51_3** in the gravity direction. A flow path forming part **51_3**C is formed between the upper end part **51_3**A and the lower end part **51_3**B.

The flow path forming part **51_3**C has the partial flow paths and the distributing and combining flow paths that are formed in the flow path forming part **51_3**C and explained in Embodiment 1.

In Embodiment 1, the example is explained in which the upper end part **51_1**A of the stacked header **51_1** is the non-horizontal face part. In Embodiment 2, the example is explained in which the lower end part **51_2**B of the stacked header **51_2** is the non-horizontal face part. In Embodiment 3, both the upper end part **51_3**A and the lower end part **51_3**B of the stacked header **51_3** are each a non-horizontal face part. Because the other configurations are the same as those of the distributor, the stacked header **51_1**, the heat exchanger **1_1**, and the air-conditioning apparatus **91** according to Embodiment 1, the explanations of the other configurations will be omitted.

In other words, in the heat exchanger **1_3** according to Embodiment 3, the upper end part **51_3**A and the lower end part **51_3**B of the stacked header **51_3** are each the non-horizontal face part having a non-horizontal face slanted to a horizontal plane.

Further, as illustrated in FIG. **17**, the heat exchanger **1_3** is formed by connecting two or more of the stacked headers **51_3** together in the gravity direction. More specifically, in the heat exchanger **1_3**, the lower end part **51_3**B of the stacked header **51_3** positioned at an upper point in the gravity direction is positioned close to the upper end part **51_3**A of the stacked header **51_3** positioned at a lower point in the gravity direction.

<Configuration of Stacked Headers **51_3**>

Next, a configuration of any of the stacked headers **51_3** included in the heat exchanger **1_3** according to Embodiment 3 will be explained.

FIG. **18** is a perspective view in an exploded state of any of the stacked headers **51_3** included in the heat exchanger **1_3** according to Embodiment 3. FIG. **19** is an explanatory drawing for explaining a water flow in any of the stacked headers **51_3** included in the heat exchanger **1_3** according to Embodiment 3, in comparison to that in a conventional example. FIG. **20** is a plan view of any of the stacked headers **51_3** included in the heat exchanger **1_3** according to Embodiment 3. FIG. **21** is a lateral view of any of the stacked headers **51_3** included in the heat exchanger **1_3** according to Embodiment 3. FIG. **22** is a front view of any of the stacked headers **51_3** included in the heat exchanger **1_3** according to Embodiment 3. FIG. **23** is a perspective view of any of the stacked headers **51_3** included in the heat exchanger **1_3** according to Embodiment 3.

In FIG. **18**, the arrows indicate flows of the refrigerant observed while the distributing and combining flow path **51***a* of any of the stacked headers **51_3** is serving as a distributing flow path.

FIG. **19**(*a*) illustrates the upper end part **510**A and the lower end part **510**B of the conventional stacked header **510**, whereas FIG. **19**(*b*) illustrates the upper end part **51_3**A and the lower end part **51_3**B of any of the stacked headers **51_3**.

FIG. **20** is a plan view of any of the stacked headers **51_3** as being viewed from above.

FIG. **21** is a lateral view of any of the stacked headers **51_3** as being viewed from either windward or leeward in the passage direction of the air passing through the heat exchanging part **2**.

FIG. **22** is a front view of any of the stacked headers **51_3** as being viewed from the flowing direction of the refrigerant.

FIG. **23** is a perspective view of any of the stacked headers **51_3** as being viewed diagonally from above.

As illustrated in FIG. **18**, similarly to the stacked header **51_1** according to Embodiment 1, the stacked header **51_3** is formed by stacking together the plurality of first plates **53_1** to **53_6** and the plurality of second plates **54_1** to **54_5** alternately interposed between the first plates **53_1** to **53_6**.

Further, the stacked header **51_3** is attached to the heat exchanging part **2** in such a manner that the longitudinal direction of the stacked header **51_3** extends parallel to the gravity direction. In the stacked header **51_3**, the upper end part **51_3**A is formed at the upper end of the stacked header **51_3** in the gravity direction, whereas the lower end part **51_3**B is formed at the lower end of the stacked header **51_3** in the gravity direction.

The configurations other than the upper end and the lower end of each of the plates, the partial flow paths formed in the plates, and the distributing and combining flow paths formed as a result of stacking the plates together are the same as those in the stacked header **51_1** according to Embodiment 1.

Further, the flows of the refrigerant in the stacked header **51_3** are also the same as those in the stacked header **51_1** according to Embodiment 1.

As illustrated in FIG. **18**, as a result of stacking the plates together, the stacked header **513** is assembled.

Incidentally, while the heat exchanger **1_3** is being used as an evaporator, the temperature of the refrigerant flowing through the heat exchanging part **2** is lower than the temperature of the outdoor air. As a result, the surface temperature of the stacked header **51_3** becomes lower than the dew point temperature of the air, Consequently, as illustrated in FIG. **19**, water drops (condensed water W) adhere to the surface of the stacked header **51_3**.

As illustrated in FIG. **19**(*a*), in the conventional stacked header **510**, the upper end part **510**A and the lower end part **510**E are each a horizontal face part. For this reason, the condensed water W adhering to the upper end part **510**A and the lower end part **510**E of the stacked header **510** stagnates as explained in Embodiments 1 and 2 and does not easily flow downward. Because the condensed water W stagnates, the stacked header **510** may be corroded. Also, after a defrosting operation, when drain water accumulates at the upper end part **510**A and refreezes, the drain water extends upward in the gravity direction and pushes up the stacked header **510** positioned above. The stacked header **510** being pushed up may be deformed.

In contrast, as illustrated in FIG. **17**, FIG. **18**, FIG. **19**(*b*), and FIG. **20** to FIG. **23**, in the stacked header **51_3**, both the upper end part **51_3**A and the lower end part **51_3**B are each a non-horizontal face part. For this reason, even when the condensed water W adheres to the upper end part **51_3**A and the lower end part **51_3**B of the stacked header **51_3**, the condensed water W flows downward along the surface at both of the end parts. In particular, because the upper end part **51_3**A and the lower end part **51_3**B are each formed to have an arc shape, the condensed water W adhering to the upper end part **51_3**A and the lower end part **51_3**B flows downward along the arc. In this manner, the condensed water W can smoothly descend to be discharged, without stagnating.

Consequently, by using the stacked header **51** it is possible to prevent the condensed water W from stagnating at the upper end part **51_3**A and the lower end part **51_3**B. It is therefore possible to prevent the stacked header **51_3** from being corroded. Consequently, it is possible to provide the heat exchanger **1_3** having high reliability.

Further, even when the condensed water W freezes, neither of the stacked headers **51_3** positioned above and below will be deformed. This configuration therefore contributes to enhancement of reliability.

As illustrated in FIG. **17**, by making the upper end and the lower end of each of the plates have an arc shape, the upper end part **51_3**A and the lower end part **51_3**B each having a semi-circular columnar shape are formed as illustrated in FIG. **16**. In other words, the upper end part **51_3**A and the lower end part **51_3**B are each formed to have a curved face descending from a centerline of a corresponding one of the upper end part **51_3**A and the lower end part **51_3**B extending parallel to the flowing direction of the refrigerant, windward and leeward in the passage direction (indicated with the outlined arrow in the drawing) of the air passing through the heat exchanging part **2**.

It should be noted, however, that it is only required that the upper end part **51_3**A and the lower end part **51_3**B are each a non-horizontal face part. The apex of the arc-shaped part at the upper end of each of the plates does not necessarily have to be positioned on the centerline of a corresponding one of the upper end part **51_3**A and the lower end part **51_3**B extending parallel to the flowing direction of the refrigerant.

For example, it is acceptable to adopt any of the shapes illustrated in FIG. **4** to FIG. **8** explained in Embodiment 1 as the shape of each of the upper end part **51_3**A and the lower end part **51_3**B of the stacked header **51_3**.

Furthermore, the shape of the upper end part **51_3**A and the shape of the lower end part **51_3**B may be the same as each other or may be different from each other.

Further, the heat exchanger **1_3** according to Embodiment 3 may be installed as the outdoor heat exchanger **94** into the air-conditioning apparatus **91** according to Embodiment 1.

Further, while the outdoor heat exchanger **94** is being used as an evaporator, the temperature of the refrigerant may become lower than the temperature of the outdoor air. As a result, the surface temperature of the stacked header **51_3** becomes lower than the dew point temperature of the air, and water drops (condensed water) adhere to the surface of the stacked header **51_3**, Because the upper end part **51_3**A and the lower end part **51_2**B of the stacked header **51_3** are each the non-horizontal face part, the condensed water generated at the upper end part **51_3**A and the lower end part **51_3**B of the stacked header **51_3** flows downward along the surfaces of the upper end part **51_3**A and the lower end part **51_3**B of the stacked header **51_3**. Consequently, the condensed water smoothly descends without stagnating at the upper end part **51_3**A and the lower end part **51_3**B of the stacked header **51_3**.

Further, when the temperature of the outdoor air decreases to lower than 0 degrees C., the condensed water may become frost and accumulate in the stacked header **51_3**. At the same time, frost may accumulate on the fins (the windward fins **23**, the leeward fins **33**). To solve this problem, the air-conditioning apparatus **91** is configured to melt the accumulating frost by performing a defrosting operation either regularly or when a certain starting condition is satisfied. Further, after performing the defrosting operation, the air-conditioning apparatus **91** is configured to perform a heating operation again, but any of the condensed water failed to be discharged freezes again. In the conventional stacked header **510**, because drain water stagnates at the upper end part **510**A, a large amount of water refreezes. When the defrosting operation is repeatedly performed, the frost is not melted completely, but remains as ice, and such frost and ice grow upward. Because the stacked header **510** positioned above is pushed up by the growing ice, a joint or the heat transfer tubes connecting the heat exchanger to the stacked header **510** may be deformed.

In contrast, in the stacked header **51_3**, the drain water melted by the defrosting operation is discharged without stagnating at the upper end part **51_3**A. Consequently, it is possible to reduce the amount of water that refreezes during a heating operation performed after the defrosting operation. Even when some amount of water refreezes, because the amount of water that refreezes is small, the stacked header **510** positioned above is not pushed up. Consequently, it is possible to avoid the case where the heat exchanger **1_3** is damaged by the refrozen water.

Consequently, it is possible to prevent the condensed water from stagnating at the upper end part **51_3**A and the lower end part **51_3**B of the stacked header **51_3**. It is therefore possible to prevent the stacked header **51_3** from being corroded by a long-term stagnation of the condensed water. Consequently, it is possible to provide the heat exchanger **1_3** having high reliability.

Further, in the stacked header **51_3**, it is possible to significantly prevent the condensed water from stagnating at the upper end part **51_3**A and the lower end part **51_3**B, and it is thus possible to reduce the amount of water that refreezes. Consequently, the stacked header **51_3** positioned above is not pushed up. This configuration therefore contributes to enhancement of reliability of the heat exchanger **1_3**.

In Embodiment 3, the stacked header **51_3** is explained as an example of the distributor; however, the structures of the upper end part **51_3**A and the lower end part **51_3**B described in Embodiment 3 are also applicable to flow paths of distributors and distributing devices using pipes having a more commonly-used configuration.

REFERENCE SIGNS LIST

1_1 heat exchanger **1_2** heat exchanger **1_3** heat exchanger **2** heat exchanging part **3** distributing and combining part **21** windward heat exchanging part **22** windward heat transfer tube **22*a*** folded part **22*b*** end

22*c* end **23** windward fin **31** leeward heat exchanging part **32** leeward heat transfer tube **32***a* folded part **32***b* end **32***c* end **33** leeward fin **41** windward joint part **42** leeward joint part **43** liaison pipe

51_1 stacked header **51_1**A upper end part **51_1**B lower end part

51_1C flow path forming part **51_2** stacked header **51_2**A upper end part **51_2**B lower end part **51_20** flow path forming part **51_3** stacked header

51_3A upper end part **51_3**B lower end part **51_30** flow path forming part **51***a* distributing and combining flow path **51***a***_1** first distributing and combining flow path **51***a***_2** second distributing and combining flow path **51***a***_3** third distributing and combining flow path **51***a***_4** fourth distributing and combining flow path **52** connection pipe **53_1** first plate **53_1***a* partial flow path **53_2** first plate **53_2***a* partial flow path **53_2***b* partial flow path **53_3** first plate

53_3*a* partial flow path **53_4** first plate **53_4***a* partial flow path **53_4***b* partial flow path **53_5** first plate **53_5***a* partial flow path **53_5***b* partial flow path **53_6** first plate **53_6***a* partial flow path **54_1** second plate **54_1***a* partial flow path **54_2** second plate **54_2***a* partial flow path **54_3** second plate **54_3***a* partial flow path **54_4** second plate **54_4***a* partial flow path **54_5** second plate

54_5*a* partial flow path **57** connection pipe **6***l* cylindrical header **61***a* distributing and combining flow path **62** connection pipe **63** circular cylinder part **64** connection pipe **91** air-conditioning apparatus **92** compressor **93** four-way valve **94** outdoor heat exchanger **95** expansion device **96** indoor heat exchanger **97** outdoor fan **98** indoor fan **99** controller **510** stacked header

510A upper end part **510**E lower end part W condensed water

The invention claimed is:

1. A stacked header comprising a plurality of plates stacked together and branching one flow path into a plurality of flow paths, wherein the stacked header includes:

an upper end part positioned at an upper end of the stacked header;

a lower end part positioned at a lower end of the stacked header; and

a flow path forming part positioned between the upper end part and the lower end part and having a flow path formed in the flow path forming part, wherein

adjacent ones of the plurality of plates have different lengths so that at least one of the upper end part or the lower end part comprises a non-horizontal face part having a non-horizontal face slanted with respect to a horizontal plane, and

the at least one of the upper end part or the lower end part of the plurality of plates stacked together is the non-horizontal face part as a whole.

2. The stacked header of claim **1**, wherein the non-horizontal face part is shaped to descend in two directions orthogonal to the flow path formed in the flow path forming part, the flow path serving as a boundary between the two directions.

3. The stacked header of claim **1**, wherein the non-horizontal face part is shaped to descend in directions of the flow path formed in the flow path forming part, a middle part of the flow path serving as a boundary between the directions.

4. The stacked header of claim **1**, wherein the non-horizontal face part has an arc-shaped cross-section.

5. The stacked header of claim **1**, wherein the non-horizontal face part has a triangular cross-section.

6. The stacked header of claim **1**, wherein the non-horizontal face part has a shape slanted in one direction with different heights of lateral faces of the flow path forming part.

7. The stacked header of claim **1**, wherein

the stacked header is a first stacked header and the heat exchanger includes a second stacked header that is like the first stacked header, and

the stacked headers are arranged such that the first stacked header is above the second stacked header, and

at least one of the lower end part of the first stacked header or the upper end part of the second stacked header comprises the non-horizontal face part.

8. The stacked header of claim **1**, wherein at least one of an upper end or lower end of each of the plurality of plates has a curved face or slanted face.

9. A heat exchanger comprising:

the stacked header of claim **1**, and

a plurality of heat transfer tubes connected to the stacked header.

10. An air-conditioning apparatus, comprising the heat exchanger of claim **9**.

11. A heat exchanger comprising the stacked header according to claim **1**, wherein the heat exchanger is used as an evaporator, when a temperature of refrigerant flowing in the evaporator causes a surface temperature of the upper end part or the lower end part to be lower than a dew-point temperature of air surrounding the evaporator, water droplets form on the upper end part or the lower end part, and the non-horizontal face part having a non-horizontal face slanted with respect to a horizontal plane causes the water droplets to flow away from the upper end part or the lower end part to reduce corrosion of the stacked header.

* * * * *